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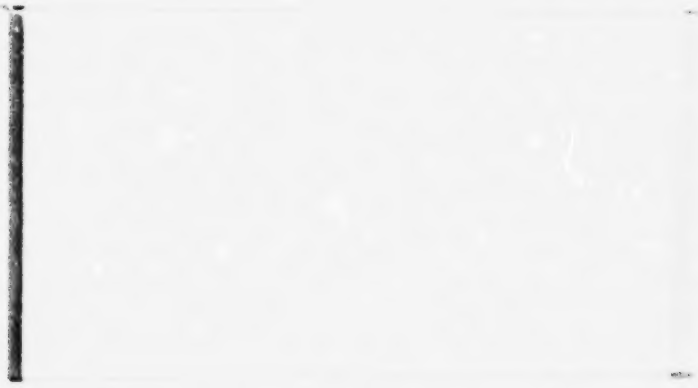

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PRE-OPERATIONAL FUEL STORAGE AREA GROUNDWATER QUALITY STUDIES 1979-1981 THUNDER BAY TGS EXTENSION

Report No 83-130-K

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ABSTRACT

Data on the physical and chemical characteristics of groundwaters from the fuel storage areas at Thunder Bay TGS, for the years 1979-81, are presented in this report. In general, the data on the groundwater quality for the three years are similar. The pattern of high sulphate concentrations around the bituminous coal pile observed by London Monenco Consultants in 1979, is also evident in the 1980 and 1981 data. Potential changes in groundwater quality expected to be effected by lignite stockpiling and by the drainage ditches constructed around the fuel storage areas are not evident in the 1981 data. These expected changes might occur during 1982 and may become evident in the 1982 data.

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To Dr. W.R. Effer
Manager
Environmental Studies & Assessments
Design & Development Division

PRE-OPERATIONAL FUEL STORAGE AREA
GROUNDWATER QUALITY STUDIES - 1979-1981
THUNDER BAY TGS EXTENSION

A survey of groundwater quality in the vicinities of the bituminous and the lignite coal storage areas for the Thunder Bay TGS Extension (TBTGS) was conducted during 1981. This is the last of three 'pre-operational' surveys conducted to obtain baseline data on the area's groundwater quality as it existed when only Unit #1 was in operation and prior to start-up of Units #2 and #3. All data acquired by the three surveys, the first conducted in 1979 by London Monenco Consultants (LMC)/1/ and the next two, in 1980/2/ and in 1981, by Ontario Hydro, are presented and examined in this report.

These surveys were conducted at the request of Ontario Hydro's Environmental Studies & Assessments Department on behalf of the Thunder Bay Project.

The purpose of this three year survey was to obtain baseline data on the local hydrology and on groundwater chemistry which, together with data from the design verification (post-operational) surveys which will be conducted in 1982, 1983 and 1985, can be used to evaluate environmental impacts due to:

(i) The placement of a lignite coal storage pile and of the coal transfer activities north of the plant.

(ii) The construction in 1981 of drainage ditches around the lignite coal storage area and the bituminous coal pile (shown in Figure 1) to collect and hold, in a pond, surface run-off to minimize infiltration of leachate to the groundwater.

The accumulated data will also be used to predict or identify any future changes in groundwater quality and the need for any corrective action to be taken.

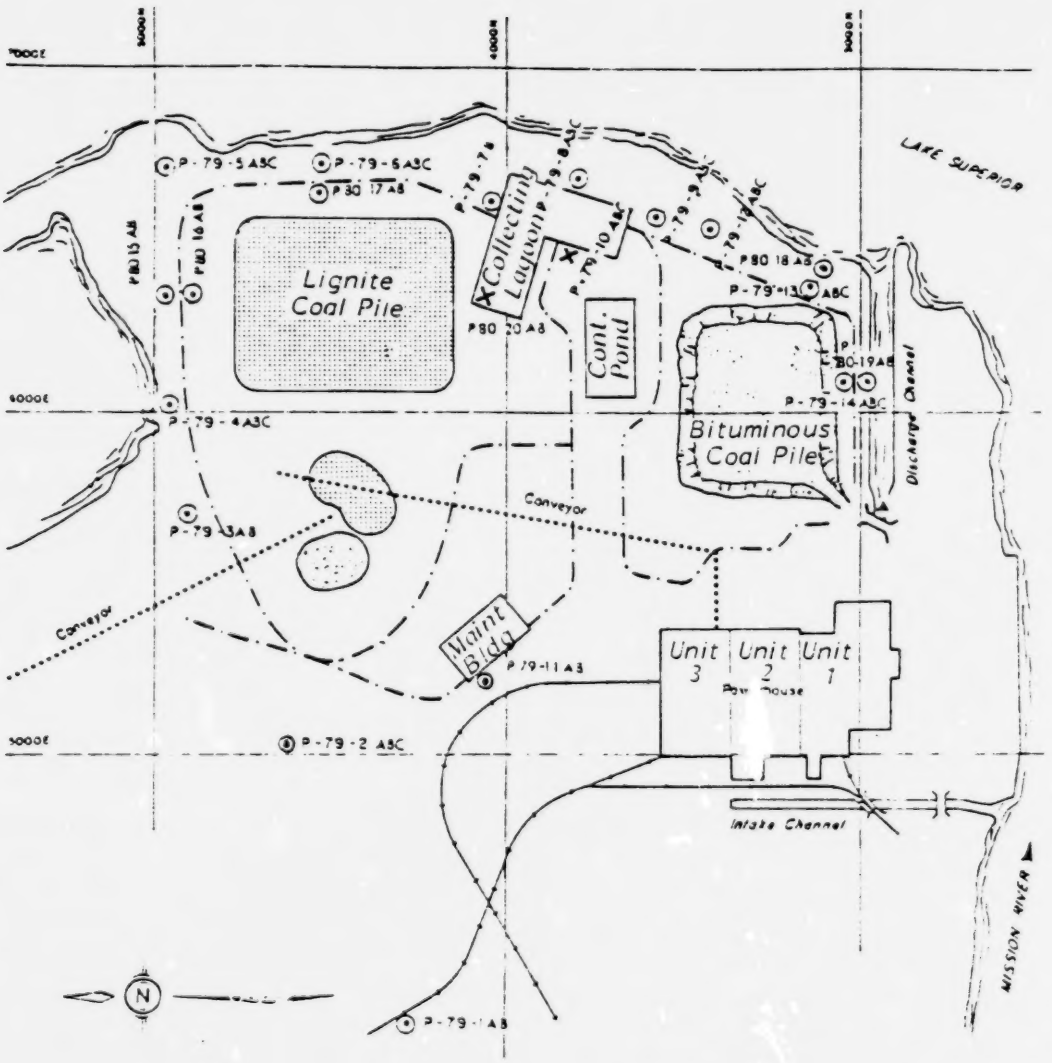

FIGURE 1

PIEZOMETER, PONDS, DITCHES
AND FUEL STORAGE LOCATIONS
THUNDER BAY TGS EXTENSION
1981

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HISTORY OF THE FUEL STORAGE AREA - TO END OF 1981

The following is a brief outline of the main events in the history of the 'Fuel Storage Areas' shown in Figure 1.

(1) The coal pile for Unit #1 (sub-bituminous coal) has existed since the 1950's.

(2) Coal (lignite) for Units #2 and #3 has been stockpiled in the 'lignite storage area' since late 1980. New lignite was stockpiled beginning in early 1981.

(3) Ditches to intercept coal pile drainage (Figure 1) were completed in November 1981.

METHODOLOGY

To obtain raw data needed to characterize the hydrology and the quality of runoff and the natural groundwater in the coal storage areas the following procedures for the monitoring programs were set-up.

1 - Piezometer Water Level Surveys

Measurements of water levels in all existing piezometers were taken by LMC in June and September of 1979 and by TBTGS personnel on five occasions in 1981. Water levels were not measured in 1980. The levels were reported as elevations related to the average lake shoreline level of 182.88 m (600 ft) in the Thunder Bay area.

Included in this part of the program were:

(a) Installation of six piezometer nests (12 piezometers).

(b) Annual piezometer levelling surveys in the spring to ensure that water level measurements were accurate.

(c) Any required maintenance to prevent ingress of surface water.

Personnel from the Civil Research Department carried out this work.

2 - Groundwater Sampling

Groundwater sampling by station personnel was scheduled for June, September and November for each annual survey and from each piezometer. Water samples from the runoff holding pon's were also collected on one occasion in 1981 for comprehensive analysis. In general, the following water level measurement and sampling procedures were followed.

(a) Bailing - Groundwater levels in each piezometer were measured and recorded. The water from each piezometer was bailed out with a hand operated pump or a vacuum pump.
- Four days later the water from each piezometer was bailed out again.

(b) Sampling - One day after the second bailing, 1 L of groundwater from each piezometer was collected into an acid cleaned LPE bottle.
- The water's pH was measured immediately with a portable pH meter.

(c) Preparation - All samples collected were kept in a refrigerator at about 4°C.
- The samples were filtered as quickly as possible using a 0.45 µm prewashed Millipore filter.
- A pretreated 500 mL LPE bottle was filled with the filtrate to which were added 2.5 mL of "ULTREX" HNO_3.
- A portion of the remaining filtrate was used for selected field tests.

(d) Shipping - The remaining filtrate (from c) was kept at about 4°C in a cooler with ice packs, and shipped, together with the acidified samples, to Research Division, by Air Express, for analysis.

3 - Groundwater Tests & Analysis

(a) Partial Analysis at TBTGS

The characteristics determined were pH, conductivity, acidity, alkalinity, chloride, sulphate, sodium, calcium, magnesium, iron, manganese and boron.

(b) Comprehensive Analysis - Research Division

Comprehensive chemical analyses of groundwater samples taken in July 1980 and in May 1981 were carried out by the Research Division. The characteristics determined are shown below:

pH	Total P as PO_4	Ba	Mn	Ni
Conductivity	F	Al	V	Sn
Alkalinity	Ca	Si	Cr	Zn
Acidity	Mg	Th	Cu	As
SO_4	Na	Be	Mo	B
Cl	K	Fe	Ag	Pb
NO_3	Sr	Ti	Co	Se
				Cd
				Hg

(c) Analytical Methods

The analytical methods used were mainly those outlined in the Standard Methods for the Examination of Water and Wastewater, 14th Edition, published by the American Public Health Association. Ion chromatography, neutron activation and other instrumental techniques, currently in general use by the Analytic Section, were also used for some determinations.

4 - Rationale

(a) Field Tests

Because some parameters of natural waters change after sampling, characteristics such as pH, acidity, alkalinity and conductivity, were performed in the field by station personnel. Determinations of other parameters were also performed in the field when availability of staff and time permitted.

(b) Comprehensive Analysis

Because of their complexity and time required comprehensive analyses were carried out by Research Division.

(c) Parameter Significance

Of the parameters determined, pH, conductivities and concentrations of acidity, alkalinity, SO_4 and Fe are considered as the main indicators of coal leachates. These parameters were used to distinguish between contaminated groundwaters and local surface waters.

The above indicators of coal leachates are common to both the bituminous and the lignite coals. However, the two types of leachates differ in their acidity and alkalinity levels. Leachates from bituminous coal are usually very acidic (low pH and low alkalinities). Leachates from freshly stock-piled lignite coal are usually alkaline (pH >7 and low acidity)/3/.

Sulphate is regarded to be the most reliable indicator of the presence of bituminous coal leachates. High iron concentrations and low pH levels (high acidity and low alkalinity) are also indicative but they are more prone to modification on passage through the soil. The remaining parameters are less reliable contaminant indicators but do help in general characterization of water quality.

The main contaminant indicator parameters and other selected analytical data, including trace metals, that will be obtained in each subsequent year on the groundwater characteristics, will

be presented in future summary annual reports in the form of graphs, tables and Piper plots to aid in identifying any changes that can be attributed to coal leachate seepage into the natural groundwater in the fuel storage areas.

FIELD AND LABORATORY WORK - Conducted in 1981*

(1) Piezometer Network Level Survey

Piezometer elevation surveys were carried out by personnel from the Civil Research Department. Piezometer locations are shown in Figure 1.

(2) Groundwater Level Surveys

Measurements of groundwater levels in the existing piezometers were carried out on five occasions during 1981 by station personnel.

(3) Groundwater Sampling and Analyses

Sampling of groundwaters for partial analyses by station personnel was carried out in May and August. Sampling for comprehensive analysis by the Chemical Research Department was carried out in May.

RESULTS

(1) Piezometer Levels

Piezometer reference levels (top of stand-pipe elevation above the average shoreline level of 182.88 m) determined on July 16 and November 2, 1981, are shown in Table I. Included are the levels determined by LMC in 1979 (shown originally in Table B-2, in their 1980 report)/1/, and by Ontario Hydro in 1980/2/.

(2) Groundwater Levels

Measurements of groundwater levels carried out in April, May, July, August and September of 1981, are shown in Table II. Included are the levels determined by LMC in 1979. Water levels for 1980 were not determined.

(3) Groundwater Characteristics

The analytical results obtained at Thunder Bay TGS, and at Research, on groundwater samples taken on May 11 and August 26, 1981, are shown in Appendix A. Included are data obtained in 1979 by LMC and in 1980 by Ontario Hydro.

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* For previous studies refer to references 1 and 2.

TABLE I

FUEL STORAGE AREA - GROUNDWATER MONITORING PROGRAM - 1981
THUNDER BAY TGS EXTENSION

PIEZOMETER REFERENCE LEVELS
(1979-1981)

Piezometer Identification		Piezometer Reference Levels, m (Relative to Average Shoreline Level of 182.88 m)						
		Date Surveyed						
Well	Number	(1) 1979	(1)(2) 1980	(3) Δ	(2) July 16/81	Δ	Nov 2/81	Δ
P79	1A	2.76	2.77		NA			
	1B	2.72	2.73		NA			
P79	2A	3.13	3.14		NA			
	2B	3.14	3.15		NA			
	2C	3.13	3.14		NA			
P79	3A	1.80	1.81		NA			
	3B	1.87	1.88		NA			
P79	4A	3.00	3.01		2.99	-0.02	3.05	0.06
	4B	2.98	2.99		2.94	-0.05	3.01	0.07
	4C	3.02	3.03		2.97	-0.06	3.04	0.07
P79	5A	3.50	3.51		3.42	-0.09	3.55	0.13
	5B	3.55	3.56		3.48	-0.08	3.61	0.13
	5C	3.61	3.62		3.52	-0.10	3.65	0.13
P79	6A	3.18	3.19		3.17	-0.02	3.30	0.13
	6B	2.96	2.97		3.00	0.03	3.14	0.14
	6C	2.75	2.76		2.73	-0.03	2.87	0.14
P79	7A	2.39	2.40		2.42	0.02	2.42	0.00
	7B	2.73	2.73		2.72	-0.01	2.74	0.02
	7C	2.89	2.90		2.93	0.03	2.93	0.00
P79	8A	2.41	2.42		2.42	0.00	2.46	0.04
	8B	2.63	2.64		2.65	0.01	2.68	0.03
	8C	2.57	2.58		2.58	0.00	2.64	0.06
P79	9A	2.10	2.11		2.38	0.27	2.37	-0.01
	9B	2.09	2.10		2.43	0.33	2.43	0.00
	9C	2.11	3.04		2.70	-0.34	2.39	-0.31
P79	10A	2.55	2.50		NA			
	10B	2.64	2.66		NA			
	10C	2.66	2.66		NA			
P79	11A	2.90	2.91		NA			
	11B	2.90	2.91		NA			
P79	12A	1.78	1.79		2.19	0.40	2.05	-0.14
	12B	1.83	1.84		2.18	0.34	2.15	-0.03
	12C	1.88	1.89		2.08	0.19	2.17	0.09
P79	13A	2.06	2.06		2.16	0.10	2.13	-0.03
	13B	2.03	2.04		2.17	0.13	2.14	-0.03
	13C	2.03	2.02		2.22	0.20	2.19	0.03
P79	14A	2.25	2.26		2.33	0.07	2.33	0.00
	14B	2.20	2.21		2.34	0.13	2.30	-0.04
	14C	2.25	2.25		2.37	0.12	2.29	-0.08
P80	15A		3.60		3.47	-0.13	3.58	0.11
	15B		3.56		3.51	-0.05	3.61	0.10
P80	16A		3.38		3.26	-0.12	3.36	0.10
	16B		3.31		3.34	0.03	3.43	0.09
P80	17A		3.35		2.87	-0.48	3.01	0.14
	17B		2.95		3.28	0.33	3.41	0.13
P80	18A		2.17		2.25	0.08	2.21	-0.04
	18B		2.17		2.24	0.07	2.20	-0.04
P80	19A		2.27		2.31	0.04	2.27	-0.04
	19B		2.66		2.70	0.04	2.66	-0.04
P80	20A		2.92		2.94	0.02	2.87	-0.04
	20B		2.54		2.55	0.01	3.14	0.59

(1) London Monenco Consultants Ltd., Baseline Report for Ontario Hydro Thunder Bay TGS Extension - Groundwater Monitoring Study - Coal Storage Area (B-2) Feb. 1980.

(2) Ontario Hydro Data. 1980 - from 15A to 20B. The remaining values are rounded 1979 LMC values.
1981 - NA = Not available.

(3) No change - Previous levels are the same (LMC) or original (OH).

Δ Change from previous levels (m).

TABLE B-2

Water Level Measurements and Piezometer Construction Details
(Metric Units)

PIEZOMETER		GROUND ELEVATION (m)	WATER LEVEL						STANDPIPE			SCREEN				
			ELEVATION (m)		DEPTH BELOW GROUND (m)		DEPTH BELOW STANDPIPE (m)		ELEVATION (m)	HEIGHT ABOVE GROUND (m)*	DEPTH BELOW GROUND (m)	TYPE**	LENGTH (m)	DEPTH BELOW GROUND (m)		DEPTH BELOW STANDPIPE (m)	
IDENTIFICATION	CO-ORDINATES		JUNE 14	SEPT 27	JUNE 14	SEPT 27	JUNE 14	SEPT 27						from	to	from	to
79-1-A	4300N, 4220E	186.61	186.26	186.16	0.39	0.47	1.40	1.48	185.618	1.01	3.06	1	0.76	2.20	2.93	2.96	3.67
79-1-B	4312N, 4226E	186.61	DRY	DRY	DRY	DRY	DRY	DRY	185.604	0.97	0.93	2	0.15	0.12	0.84	0.87	1.41
79-2-A	4588N, 5069E	186.97	186.56	186.05	0.41	0.91	1.45	1.95	186.004	1.04	3.98	2	0.99	2.96	3.93	3.91	4.92
79-2-B	4587N, 5066E	186.97	186.56	186.06	0.41	0.91	1.45	1.96	186.018	1.05	2.31	2	1.00	1.68	2.68	2.68	3.68
79-2 C	4585N, 5062E	186.92	186.64	186.06	0.33	0.92	1.37	1.96	186.014	1.06	1.81	2	1.00	0.78	1.78	1.78	2.78
79-3-A	4866N, 5631E	183.76	183.50	183.47	0.19	0.22	1.18	1.21	184.680	0.99	3.35	2	1.00	3.25	3.25	3.25	4.25
79-3-B	4866N, 5626E	183.76	183.69	183.69	0.14	0.14	1.26	1.26	184.753	0.92	1.42	2	1.00	0.38	1.38	1.39	2.39
79-4-A	4910N, 6016E	184.91	183.43	183.49	1.48	1.42	2.45	2.39	185.838	0.97 (0.28)	4.48	2	1.00	3.76	4.76	4.73	5.73
79-4-B	4910N, 6039E	184.91	183.43	183.51	1.48	1.40	2.43	2.35	185.856	0.95 (0.25)	3.50	1	0.46	3.00 - 3.46		3.95 - 4.41	
79-4-C	4910N, 6052E	185.91	183.53	183.53	1.38	1.38	2.57	2.57	182.872	0.92 (0.30)	2.84	1	0.56	2.38 - 2.85		2.73 - 3.29	
79-5-A	4980N, 6686E	185.48	183.34	183.43	2.13	2.05	3.03	2.95	186.380	0.90 (0.23)	8.52	1	0.46	8.01 - 8.49		8.93 - 9.39	
79-5-B	4978N, 6686E	185.48	183.42	183.42	2.12	2.06	3.01	3.01	186.433	0.95 (0.83)	6.03	1	0.46	5.56 - 6.00		6.49 - 6.95	
79-5-C	4976N, 6686E	185.48	183.42	183.42	2.11	2.06	3.07	3.06	186.486	1.01 (0.82)	4.47	4	0.50	5.01 - 5.51		5.02 - 5.52	
79-6-A	4561N, 6761E	185.12	181.85	181.41	1.32	1.71	2.26	2.63	186.057	0.92 (0.70)	8.02	1	0.46	3.53 - 3.99		8.45 - 8.91	
79-6-B	4551N, 6741E	184.91	183.43	183.42	1.56	1.51	2.41	2.42	185.963	0.91 (0.48)	5.56	1	0.46	5.06 - 5.52		5.97 - 6.43	
79-6 C	4560N, 6751E	185.66	183.43	183.43	1.73	1.21	2.20	2.20	185.633	0.99 (0.28)	3.10	1	0.46	2.61 - 3.07		3.60 - 4.06	
79-7-A	4039N, 6661E	184.21	183.52	183.54	0.69	0.67	1.25	1.23	185.270	1.06 ( )	6.24	4	0.40	5.78 - 6.18		6.84 - 7.24	
79-7-B	4045N, 6611E	184.57	183.51	183.56	1.06	1.01	2.07	2.05	185.605	1.04 ( )	4.56	1	0.46	4.08 - 4.56		5.11 - 5.57	
79-7-C	4031N, 6661E	185.22	183.57	183.53	1.18	1.12	2.23	2.26	183.273	1.02 ( )	1.79	1	0.46	1.30 - 1.76		2.35 - 2.81	
79-8-A	3808N, 6669E	184.29	183.49	183.39	1.10	0.91	1.80	1.91	185.293	1.00 (0.33)	5.83	4	0.40	5.17 - 5.57		6.17 - 6.57	
79-8-B	3804N, 6669E	184.53	183.76	183.38	1.22	1.15	2.25	2.13	185.510	0.98 (0.62)	3.01	1	0.46	3.35 - 3.81		3.35 - 3.81	
79-8 C	3798N, 6669E	184.47	183.31	183.38	1.16	1.08	2.16	2.06	183.449	0.98 (0.52)	2.21	1	0.56	1.71 - 2.17		2.65 - 3.15	
79-9-A	3575N, 6575E	184.03	183.42	183.36	0.58	0.64	1.55	1.62	184.978	0.98	4.65	1	0.46	4.15 - 4.61		5.13 - 5.59	
79-9-B	3575N, 6578E	184.00	183.43	183.36	0.57	0.64	1.56	1.61	184.970	0.97	2.80	4	0.40	2.36 - 2.76		3.31 - 3.71	
79-9 C	3573N, 6581E	184.00	183.42	183.36	0.58	0.64	1.57	1.61	184.994	0.99	1.71	1	0.46	1.27 - 1.68		2.21 - 2.67	
79-10-A	3810N, 6452E	184.51	182.88	182.88	1.63	0.85	2.65	1.87	185.531	1.02 (0.71)	5.06	4	0.40	4.61 - 5.01		5.63 - 6.03	
79-10-B	3810N, 6455E	184.51	182.90	183.66	1.61	0.86	2.62	1.87	185.522	1.01 (0.70)	3.65	1	0.46	3.16 - 3.62		4.12 - 4.63	
79-10 C	3810N, 6457E	184.51	182.88	183.66	1.63	0.87	2.65	1.89	185.535	1.02 (0.73)	2.67	1	0.46	2.18 - 2.64		3.20 - 3.66	
79-11-A	4053N, 5276E	184.75	183.39	183.91	1.36	0.84	2.39	1.87	185.780	1.03	3.51	1	0.46	3.07 - 3.48		4.05 - 4.51	
79-11-B	4046N, 5276E	185.75	181.38	183.93	1.37	0.81	2.60	1.83	183.781	1.03	2.81	1	0.46	2.36 - 2.80		3.37 - 3.83	
79-12-A	3629N, 6562E	186.27	183.41	183.38	0.85	0.89	1.25	1.28	186.662	0.39	4.40	4	0.40	3.99 - 4.39		4.38 - 4.78	
79-12-B	3631N, 6562E	186.27	183.41	183.37	0.86	0.90	1.29	1.34	186.308	0.44	3.62	1	0.46	3.13 - 3.59		3.52 - 4.03	
79-12 C	3633N, 6562E	186.27	183.41	183.36	0.86	0.90	1.33	1.39	185.766	0.49	2.02	1	0.46	1.55 - 2.01		2.06 - 2.50	
79-13-A	3167N, 6372E	183.91	183.41	183.38	0.50	0.53	1.52	1.55	184.935	1.02	3.87	1	0.46	3.39 - 3.85		4.21 - 4.67	
79-13-B	3173N, 6372E	183.91	183.42	183.39	0.49	0.52	1.49	1.52	184.909	1.00	2.96	1	0.46	2.42 - 2.93		3.42 - 3.93	
79-13 C	3175N, 6372E	183.91	183.44	183.40	0.47	0.50	1.46	1.50	185.906	1.00	1.38	1	0.46	0.89 - 1.35		1.89 - 2.35	
79-14-A	3055N, 6086E	184.06	183.39	183.35	0.67	0.72	1.35	1.39	185.134	1.07	3.61	2	1.00	2.56 - 3.56		3.45 - 4.45	
79-14-B	3055N, 6090E	184.06	183.37	183.35	0.69	0.71	1.71	1.73	185.086	1.02	2.30	1	0.46	1.81 - 2.27		2.83 - 3.29	
79-14 C	3055N, 6094E	184.06	183.37	183.35	0.69	0.72	1.35	1.38	185.425	1.06	1.56	1	0.46	1.05 - 1.51		2.11 - 2.57	

** TYPE 1 - 50mm dia. PVC, No. 10 slot 'wire wound' screen; length = 0.76 m (2.49 ft); I.D. = 3.8 cm. (1.5 in); 12 cm (5 in) unscreened section at base.

TYPE 2 - PVC pipe with No. 10 machined horizontal slots; length = 1.00 m (3.28 ft), I.D. = 3.8 cm. (1.5 in); 1 cm (1 in) unscreened section at base.

TYPE 3 - PVC pipe with No. 10 machined horizontal slots; length = 0.46 m (1.50 ft); I.D. = 3.8 cm. (1.5 in); between 1 and 6 cm (0.4-2½ in) unscreened section at base.

TYPE 4 - 50mm dia. PVC, No. 10 slot 'wire wound' screen; length = 0.16 m (0.80 ft), I.D. = 4.2 cm. (1.25 in); 6 cm (2½ in) unscreened section at base.

* Numbered 'heights above ground' values were measured on September 24 after additional sand had been placed.

NOTE: Although the standpipe elevations have been determined to the nearest millimetre, water levels have been rounded to the nearest centimetre because of the small water level changes which occur when the weighted tape measure is lowered.

TABLE II

FUEL STORAGE AREA - GROUNDWATER MONITORING PROGRAM - 1981
THUNDER BAY TGS EXTENSION

RELATIVE PIEZOMETER AND LAKE WATER LEVELS - 1981
(Relative to Average Shoreline Level of 181.88 m)

Piezometer Identification		Relative Water Levels in Piezometers (m)						
		Dates Measurements Were Taken						
		June 14/79	Sept. 27/79	Apr. 27/81	May 3/81	July 2/81	Aug. 25/81	Sept. 4/81
P79	1A	1.36	1.28	*1.57 (F)	*1.28	*1.31	*1.05	*1.11
	1B	Dry	Dry	*1.43	*1.38	*1.29	*0.97	*1.11
P79	2A	1.68	1.17	*N.A.	*1.90	*N.A.	*0.91	*1.09
	2B	1.68	1.18	*N.A.	*1.85	*N.A.	*0.91	*1.09
	2C	1.76	1.18	*N.A.	*1.79	*N.A.	*0.92	*1.09
P79	3A	0.62	0.59	*N.A.	*N.A.	*Dry	*N.A.	*N.A.
	3B	0.61	0.61	*N.A.	*N.A.	*Dry	*N.A.	*N.A.
P79	4A	0.55	0.61	0.56	0.58	0.60	0.39	0.40
	4B	0.55	0.63	0.47	0.52	0.59	0.37	0.40
	4C	0.55	0.65	0.49	0.48	0.57	0.36	0.37
P79	5A	0.46	0.55	0.10	0.11	0.34	0.24	0.15
	5B	0.54	0.54	0.14	0.20	0.34	0.24	0.19
	5C	0.54	0.54	0.14	0.28	0.33	0.20	0.19
P79	6A	0.97	0.55	0.54	0.20	0.35	0.23	0.53
	6B	0.55	0.54	0.13	0.23	0.36	0.23	0.22
	6C	0.55	0.55	-0.30	0.18	0.31	0.21	-0.27
P79	7A	0.64	0.66	0.63	0.57	1.73	0.35	-0.37
	7B	0.65	0.68	0.91	0.53	0.72	0.34	-0.03
	7C	0.69	0.65	0.00	0.56	0.74	0.34	-0.02
P79	8A	0.61	0.51	0.67	0.42	0.72	-0.15	-0.28
	8B	0.38	0.50	0.59	0.45	0.75	-0.15	-0.25
	8C	0.43	0.50	0.31	0.43	0.71	-0.16	-0.19
P79	9A	0.54	0.48	0.73	0.49	0.51	0.38	0.44
	9B	0.55	0.48	0.60	0.43	0.49	0.39	0.43
	9C	0.54	0.48	0.93	0.76	1.49	0.69	1.75
P79	10A	0.00	0.00	*1.00 (F)	*Dry	*Dry	*N.A.	*N.A.
	10B	0.10	0.78	*1.18 (F)	*Dry	*Dry	*N.A.	*N.A.
	10C	0.00	0.76	*1.17 (F)	*Dry	*Dry	*N.A.	*N.A.
P79	11A	0.51	1.03	*1.37	*1.23	*1.09	*0.94	*1.02
	11B	0.50	1.05	*1.38	*1.24	*1.09	*0.93	*1.05
P79	12A	0.53	0.50	0.57	0.95	0.34	0.51	0.54
	12B	0.53	0.49	0.47	0.43	0.38	0.46	0.44
	12C	0.53	0.50	0.36	0.45	0.32	0.44	0.38
P79	13A	0.53	0.50	0.34	0.39	0.48	0.48	0.42
	13B	0.54	0.51	0.42	0.47	0.57	0.47	0.47
	13C	0.56	0.52	0.55	0.57	0.65	0.58	0.59
P79	14A	0.51	0.47	0.25	0.33	0.43	0.34	0.38
	14B	0.49	0.47	0.32	0.36	0.49	0.40	0.43
	14C	0.49	0.47	0.37	0.41	0.51	0.34	0.47
P80	15A			0.31	0.43	0.43	0.68	0.39
	15B			0.41	0.51	0.86	0.50	0.65
P80	16A			0.54	0.73	1.11	0.60	0.54
	16B			0.70	0.91	1.25	0.75	0.70
P80	17A			-0.13	1.00	0.67	0.05	-0.13
	17B			0.75	1.99	1.16	0.86	0.81
P80	18A			0.33	0.41	0.50	0.41	0.42
	18B			0.32	0.38	0.47	0.38	0.42
P80	19A			0.25	0.41	0.43	0.35	0.00
	19B			0.34	0.31	0.46	0.40	0.77
P80	20A			0.90	1.33	1.36	0.30	
	20B			0.95 (F)	1.24	1.33	0.78	

F = Frozen

N.A. = Not Available

* These values are based on the 1979 Piezometer Reference Levels.
The remaining values are based on July 16, 1981 Piezometer Reference Levels.

**Piezometers P80-15A to 20B are current TSTGS designations for piezometers originally designated, by Civil Research, as P80-1A to 6B.

DISCUSSION

Piezometer Reference Levels

The LMC, 1979, and the Ontario Hydro, 1980 and 1981, data on piezometer reference levels, Table I, show that the elevations of thirty-three piezometers increased from their original levels, four decreased and two remained the same. The greatest increases occurred for piezometers 20B (0.60 m), 17B (0.46 m), 9B (0.33 m), 12B (0.31 m), 12C (0.28 m), 12A (0.26 m), and 9A (0.26 m). The greatest decreases in elevations occurred for piezometer 9C (-0.65 m), from 1980 to 1981, and in piezometer 17A (-0.34 m). Due to the inconsistent reference levels reported for piezometers 9C in 1980 and 20B, for November 1981, these changes are suspected to be erroneous.

Changes in piezometer levels can be caused by natural settling of the ground, heaving of the ground by freezing, or by some local construction activities in the area. These level changes, if not known, can lead to erroneous measurements of groundwater levels. Unusual ground level changes can contribute to changes in water quality if the rate of surface or groundwater seepage becomes a major factor. At least one annual survey of piezometer elevations is therefore necessary.

Groundwater Levels

The piezometer water level data acquired during 1981 (Table II) show that groundwater levels varied from a low of 0.57 m below the average shoreline level (reference lake level of 182.88 m) in piezometer 7A on September 4, 1981, to a high of 1.90 m in piezometer 2A on May 8, 1981. Highest groundwater levels appear to be present in the areas where piezometer nests 1, 2, 11, 15, 16, 17 and 20 are located. Piezometer nests 1, 2 and 11 are inland and west of the lignite pile; piezometer nests 15, 16, 17 and 20 are around the lignite pile. The lowest groundwater levels appear to exist in the area south and southeast of the lignite pile where piezometer nests 6, 7 and 8 are located.

Groundwater levels in some piezometers (1AB, 9ABC, 10ABC, 11AB and 20AB) for April 27, 1981, appear to be abnormally high in comparison with the levels for the rest of the year. Because the waters in some piezometers were frozen when the water levels were measured the value of winter surveys is questionable. Consideration should therefore be given to cancellation of surveys during the cold months.

The relationships between groundwater levels, lake levels and total precipitation presented in Figure 2, show that, with the exception of piezometer 12A, goundwater levels were decreasing during July and August when the lake water level was high, and were increasing

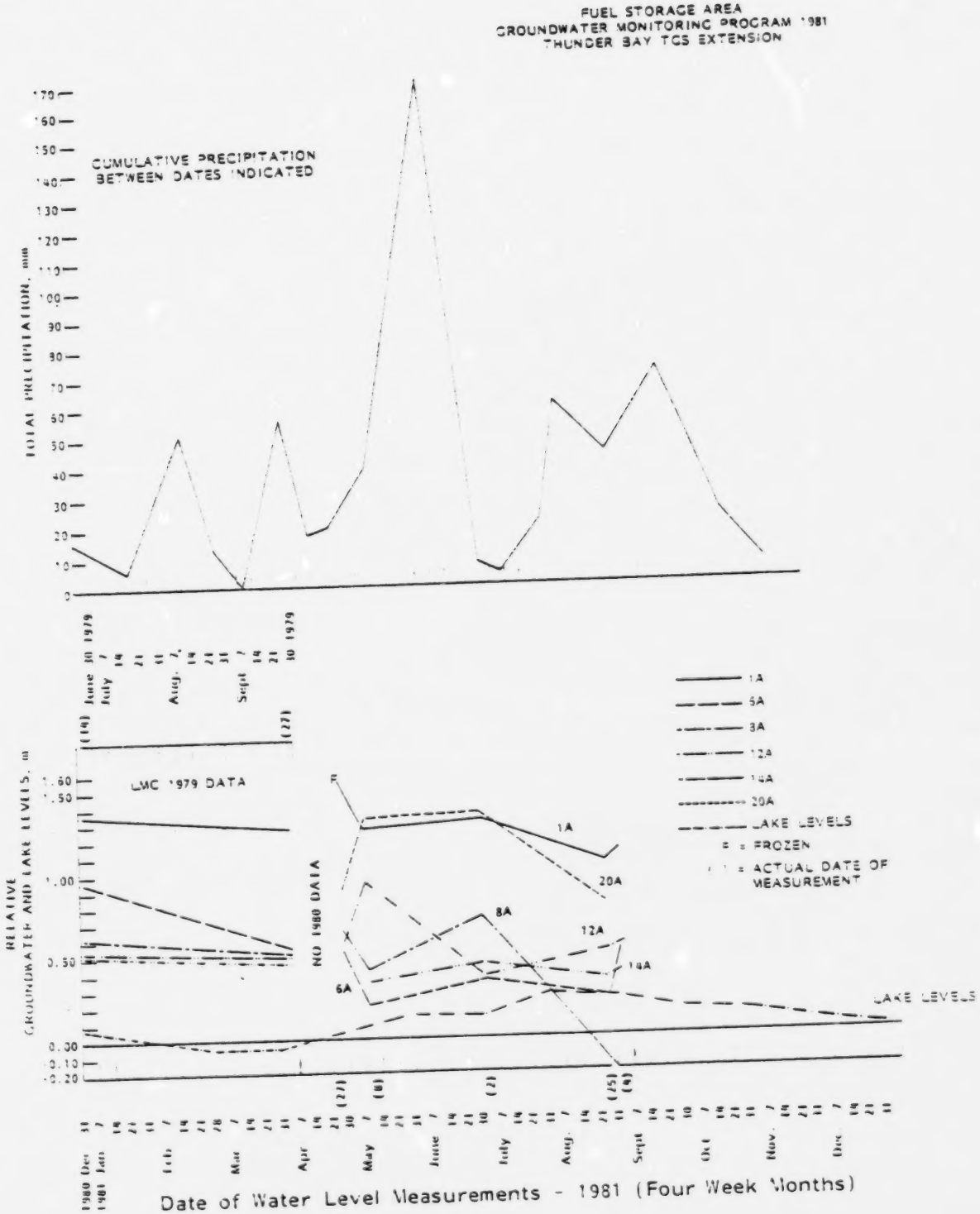


FIGURE 2

RELATIVE GROUNDWATER LEVELS (m)* - RELATIVE LAKE LEVELS (m)*
TOTAL PRECIPITATION (mm) - 1981
*(RELATIVE TO AVERAGE LAKE SHORELINE LEVEL OF 182.88 m)

158137 PD

during May and June when precipitation was high. The reason for the contrary changes of water levels in piezometer 12A is not known but could be due to local ground conditions. It appears, therefore, that groundwater levels are influenced more by precipitation and seasonal changes than by changes in lake levels.

Groundwater Quality

The data on the chemical characteristics of the groundwaters and the pond waters sampled from June 14, 1979 through 1981, are summarized in Appendix A. The major ion chemistry is illustrated by Piper diagrams and summarized by ion balances shown in Appendix B. The main characteristics of the groundwaters surrounding the lignite and the bituminous coal piles are discussed below.

1. pH

During 1979 (LMC study) the pH levels of the groundwaters taken from wells surrounding the lignite coal pile ranged from a low of 6.7 in well 8B to a high of 7.5 in wells 6B and 7B (refer to Fig 1 for locations and Table III for data). During 1980 (Ontario Hydro study) pH levels ranged from 4.7 in well 20B to 8.0 in well 4A, and during 1981 from 6.1 in well 8B to 7.8 in well 20A. With the exception of the low (acidic) pH of the water in well 20B the remaining waters in the lignite pile area were in the neutral to alkaline pH range during this three year study period.

During 1979 (the LMC study) the pH levels around the bituminous coal pile ranged from a low of 2.5 in well 13C to a high 6.3 in well 14C. During 1980 (Ontario Hydro study) pH levels ranged from 4.1 in well 13C to 7.8 in well 18A and during 1981 from 3.9 in well 13B to 6.3 in wells 14A and 18B. With the exception of the relatively high (alkaline) pH of 7.8 in the water in well 18A in 1981, the remaining waters in the bituminous coal area were in the acidic pH range during this three year study period. The data suggest that the acidities of the groundwaters in the bituminous coal area were slightly decreased during 1980 and 1981.

The pH values of waters in well 1A, some distance west of the coal piles and considered to be in the neutral area, ranged between 6.4 and 7.9. These pH levels are in the neutral pH range common to most normal natural surface and groundwaters.

On the basis of the pH levels of the groundwaters examined over the three year study period, waters in the two coal storage areas can be classified as being acidic, pH levels being below 6, in the bituminous coal area, and neutral or alkaline, pH levels greater than 6, in the lignite storage area. The low pH (4.7) of the water in well 20B, in the lignite coal area, is believed

TABLE III

SUMMARY OF GROUNDWATER
pH LEVELS FUEL STORAGE AREAS
THUNDER BAY TGS EXTENSION
1979-1981

PIEZOMETER	Sample Dates					
	June 14 1979	Sept 27 1979	July 4 1980	Sept 19 1980	May 11 1981	Aug 26 1981
1A (N)	6.6	6.8	7.9	6.4	7.5	6.4
4A (L)	7.0	7.2	8.0	6.4	7.1	6.9
5C (L)	7.1	7.1	7.7	7.2	7.3	6.7
6B (L)	7.5	7.1	7.7	7.0	7.5	6.8
6C (L)	7.0	6.8	7.7	7.5	7.6	7.4
7B (L)	7.5	7.1	7.5	7.1	7.0	7.0
8B (N)	7.2	6.7	6.5		6.1	6.8
10B (N)	6.6	6.4	6.6	6.6		
10C (N)	6.7	6.7	7.2	7.0		
12C (B)	6.0	2.8	6.2	7.2	5.9	5.6
13B (B)	5.2	3.0	4.9	6.3	3.9	5.9
13C (B)	3.6	2.5	4.1	4.2	4.2	6.1
14A (B)	5.4	5.1	4.9	6.5	4.3	6.3
14B (B)	6.0	3.3	5.4	6.4	5.0	6.1
14C (B)	6.3	5.7	5.4	6.6	5.1	6.4
15A (L)			7.8	6.8	7.1	6.5
15B (L)			7.3	7.0	7.5	6.8
16A (L)			6.6	6.8	6.6	7.0
16B (L)			7.2	7.3	6.9	6.7
17A (L)			7.0	6.8	6.7	6.5
17B (L)			7.4	6.7		6.5
18A (B)			7.8	6.4	5.1	6.2
18B (B)			6.7	6.6	4.8	6.3
19A (B)			5.6	6.5	4.8	5.1
19B (B)			5.3	6.4	4.6	6.1
20A (L)			6.3	7.5	7.8	
20B (L)			4.7	6.8	6.5	
Pond E (N)					8.2	
Pond W (N)					7.5	

(N) Neutral Zone
(L) Lignite Pile Area
(B) Bituminous Coal Pile Area

to have resulted from contamination with the acidic leachate from the bituminous coal area. The high pH (7.8) of the water in 18A, east of the bituminous coal pile and close to the lake, is believed to be the result of probable entry of lake or other natural surface water into this well.

A summary of groundwater pH levels in both fuel storage areas from 1979-1981 are shown in Table III.

2. Alkalinity and Acidity

Acidity levels were not determined with confidence in 1980 and 1981 and were, therefore, rejected and are not included in the data summary. However, the few acidity values obtained in 1979 (LMC study) show that high levels of acidity, 22 to 544 mg/L as $CaCO_3$ and simultaneously low levels of alkalinity, existed in groundwaters in wells 9B, 12BC, 13ABC and 14B, on the east and south sides of the bituminous coal pile.

Alkalinity levels ranged from zero, in wells 12C, 13BC and 14AB, south and east sides of the bituminous coal pile, to a high of 970 mg/L as $CaCO_3$, in well 17A, east of the lignite pile, and slightly lower in wells 16C, 15A and 16B also on the north and east sides of the lignite pile.

As with pH variations, waters of lowest alkalinities and highest acidities and low pH values are present in wells around the bituminous coal pile and waters of highest alkalinities (high pH levels) were present in wells around the lignite coal pile. All these observations are consistent with the known fact that the bituminuous coal pile drainage is acidic and the hypothesis that the lignite coal pile drainage is neutral to alkaline.

3. Conductivities

Groundwaters of low ionic content (low conductivities), commonly associated with natural surface waters, exist in wells 1A, 7B, 8B and 10B. Well 1A is located well inland and west of the fuel storage areas. Wells 7B, 8B and 10B are located southeast of the lignite pile and close to the shore. Waters in these locations can be said to be least affected by coal pile leachates. Groundwaters of highest ionic content were found in nests 12, 13, 14, 18, 19 and 20. With the exception of wells 20AB, located south of the lignite pile, all other wells are located east and south of the bituminous coal pile. These groundwaters can be said to be significantly affected by leachate from the bituminous coal pile.

4. Iron

The presence of iron in high concentrations (>100 mg/L) in the groundwaters examined also indicates leachate contamination. During 1979 (LMC) iron concentrations ranged from 2.9 mg/L Fe in well 1A to a high of 635 mg/L Fe in well 14A. Waters from wells 6C, 13B, 13C, 14A, 14B and 14C (all but well 6C are located east and south of the bituminous coal pile) also contained high iron concentrations. Well 6C is located on the east side of the lignite pile. During 1980 and 1981 (Ontario Hydro) iron concentrations in groundwaters ranged from a low of <1 mg/L Fe in wells 1A, 4A, 6B, 6C, 7B, 15B, 16B and 20A (all but well 1A are located around the lignite pile) to a high of 916 mg/L Fe in well 13C, located east of the bituminous coal pile.

Although high concentrations of iron in groundwaters indicate leachate contamination low concentrations do not necessarily indicate absence of contamination. Iron concentrations in groundwaters can be reduced by oxidation and precipitation while the leachate is passing through the soil. This could be responsible for the variations in iron concentrations in some of the waters examined during the surveys. Although typical normal groundwaters generally contain less than 1 mg/L of iron the LMC 1979 data show that the natural groundwaters in this area have relatively low pH levels and contain iron in concentrations greater than 1 mg/L.

5. Sulphate

Significant variations exist in sulphate concentrations in groundwaters from some wells. During the LMC study conducted in 1979, sulphate concentrations ranged from a low of 2 mg/L SO_4 in wells 5C and 6C on the east side of the lignite pile to a high of 4440 mg/L SO_4 in well 13C and somewhat lower values in wells 12C, 13B, 14A, 14B and 14C, all on the east and south sides of the bituminous coal pile. During the 1980 and 1981 studies (Ontario Hydro) sulphate concentrations ranged from a low of <1 mg/L SO_4 in wells 6B and 6C on the east side of the lignite pile to a high of 3420 mg/L SO_4 in well 14B on the south side of the bituminous coal pile. Other high concentrations were found in waters from wells 13B, 13C, 14A, 14C, 18A, 18B, 19A, 19B, 20A and 20B. All but wells 20A and 20B are on the east and south sides of the bituminous coal pile.

Sulphate concentrations in groundwaters are considered to be the most reliable indicator of the presence of bituminous coal pile leachate. (Low pH and high iron concentrations are also indicative; however, they are more prone to modifications on passing through the soil).

At present, there is no known specific indicator of the presence of leachate from the lignite coal pile other than higher alkalinities and conductivities than those of normal ground or surface waters.

Sulphate concentrations around the fuel storage areas, for the years of 1979-1981, are shown in Table IV.

The pattern of high sulphate concentrations around the bituminous coal pile observed by LMC in 1979 is evident in the 1980 and 1981 data. The very high sulphate concentrations found in 1980 in waters from the new piezometers 20A and 20B, on the south side of the lignite pile, were not present in 1981. They were, however, still generally higher than in other piezometers around the lignite pile. The higher conductivity and higher than normal iron content in the 1981 groundwater from these piezometers, together with the lower pH, suggests that during 1980 the groundwater in this area could have been contaminated in some way with leachate from the bituminous coal pile.

6. Phosphate

A major inconsistency observed in the data is the high concentrations of phosphate ion detected in waters from several piezometers (4A, 7B, 10C, 13A, 13B, 13C, 14A, and 14B) sampled in August 1980. The PO_4 concentrations in waters from these piezometers ranged from 3 to 25 mg/L PO_4 compared to <0.1 mg/L PO_4 for the remaining samples. As these high PO_4 concentrations were not detected in the 1979 and 1981 samples, the high results are considered to be due to analytical error.

7. Piper Plots

The Piper plots for each piezometer show two distinct groupings of water types, as illustrated in the following examples, Figure A7 and Figure A17, selected from those given in Appendix B. One group, Figure A7, represents groundwater in which alkaline earths and weak acid anions (HCO_3 and CO_3), resembling natural groundwater, predominate. This group represents waters mainly from piezometers surrounding the lignite pile. The other group, Figure A17, represents groundwater in which alkaline earths and strong acid anions (SO_4 and Cl) predominate. This group represents waters mainly from piezometers east and south of the bituminous coal pile.

8. Pond Waters

Two samples of pond waters, identified as Pond E and Pond W, taken from the east and west sides of the unlined collecting lagoon (See Figure 1) used for storage of rain water, site runoff and water from the drainage ditches were also examined for their characteristics. On the basis of the analytic data, presented in Appendix A, the lagoon water, on May 11, 1981, was alkaline and had a chemical composition suggesting a diluted mixture of surface waters, and probably leachates infiltrated from both coal piles. The relatively high SO_4

TABLE IV

SUMMARY OF
GROUNDWATER SULPHATE CONCENTRATIONS
FUEL STORAGE AREAS
THUNDER BAY TGS EXTENSION
1979-1981

PIEZOMETER NO	Sample Dates					
	June 14 1979	Sept 27 1979	July 4 1980	Sept 19 1980	May 11 1981	Aug 26 1981
1A (N)	5	39	77	10	<0.1*	6
4A (L)	267	72	4	64	149	59
5C (L)	2	20	8	9	<0.1*	4
6B (L)	6	6	1	9	<0.1*	3
6C (L)	2	10	1	9	<0.1*	3
7B (L)	43	47	27	11	5	
8B (N)	128	162	340		420	250
10B (N)	239	59	115	77		
10C (N)	430	145	28	9		
12C (B)	2550	3080	630	624		100
13B (B)	4200	3790	2750	1430	2300	2555
13C (B)	3940	4440	3000	1430	2660	2250
14A (B)	3260	3110	2720	1314	3360	2170
14B (B)	3790	3450	2920	1248	3420	2700
14C (B)	2040	1740	2240	1935	2400	1530
15A (L)			40	208	21	155
15B (L)			30	21	<0.1*	24
16A (L)			28	14	<0.1*	28
16B (L)			23	28	9	16
17A (L)			24	152	4	32
17B (L)			19	18		400
18A (B)			420	1926	2500	1750
18B (B)				786	3000	2000
19A (B)			2400	300	<0.1*	2150
19B (B)			3260	140	3120	2586
20A (L)			2560	162	740	
20B (L)			2800	16	3	
Pond E (N)					260	
Pond W (N)					270	

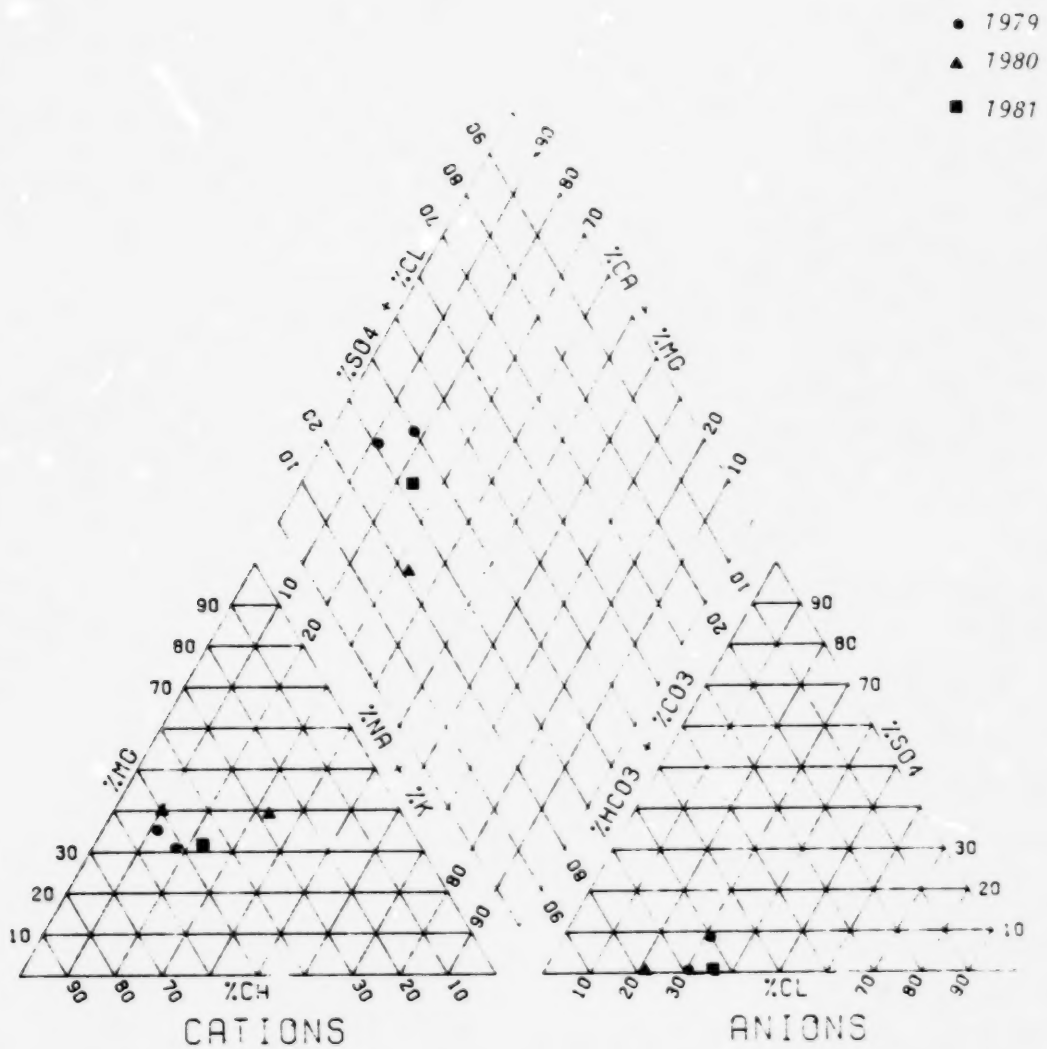
(N) Neutral Zone
(L) Lignite Pile Area
(B) Bituminous Coal Pile Area
* Probable errors

SO_4 in mg/L

FIGURE A7

PIPER DIAGRAM

MAJOR ION CHEMISTRY
TYPE - WATER
LOCATION 01A



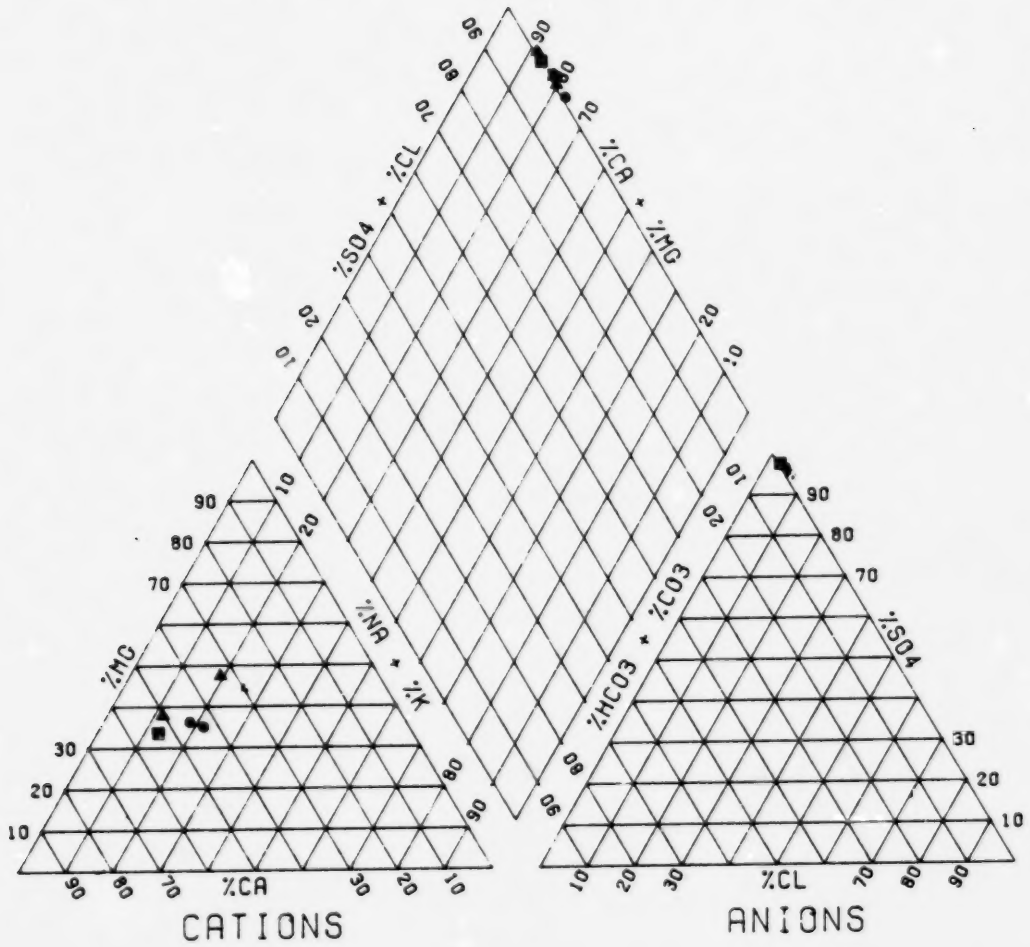
83-130

FIGURE A17

PIPER DIAGRAM

MAJOR ION CHEMISTRY
TBTGS FUEL
TYPE - WATER
LOCATION 13B

● 1979
▲ 1980
■ 1981



83-130

concentration (270 mg/L) of the lagoon waters, compared to the low SO_4 levels in groundwaters surrounding the lignite pile, suggests that leachate from the bituminous coal pile entered the lagoon. As the drainage ditches were not completed until November 1981, their total effect on the lagoon water characteristics may not yet be evident or conclusive.

9. Drainage Ditches

Examination of the data on pH and SO_4 concentrations, considered to be the main indicators of leachate contamination, in piezometers on opposite sides of the drainage ditches shows little difference in water quality. For example, pH and SO_4 concentrations in waters sampled in 1981 from piezometers 14ABC (bituminous coal pile) varied between 4.3 and 6.4 for pH and 1500 and 3500 mg/L for SO_4. Waters taken from the opposite side from piezometers 19AB, pH varied between 4.8 and 6.1 and SO_4 concentrations between 2200 and 3100 mg/L. In the lignite pile area, pH levels varied between 6.5 and 6.7 and SO_4 concentrations between 4 and 400 mg/L in piezometers 17AB and pH 6.8 and 7.6 and 3 mg/L SO_4 in piezometers 6BC. Approximately the same differences existed in waters from other similar neighbouring piezometers.

CONCLUSIONS & RECOMMENDATIONS

One annual survey of piezometer reference levels in late spring or early summer is recommended for future surveys.

The main changes in groundwater levels appear to be seasonal and/or influenced by precipitation or lack of it rather than by fluctuations in lake levels.

In general, the 1980-1981 data on the groundwater quality are similar and resemble those determined by LMC in their 1979 survey. The pattern of high sulphate concentrations around the bituminous coal pile observed by LMC in 1979 is also evident in the 1980 and the 1981 data.

The 1980 data on the groundwater around the lignite storage pile show that some groundwaters (20A & 20B) might have been affected in some way by surface drainage of leachate from the bituminous coal pile. The 1981 data, particularly the May result, show a significant reduction in SO_4 concentrations and in the degree of groundwater contamination that was suspected to have occurred in 1980.

Potential changes in groundwater quality expected to be effected by lignite stockpiling since late 1980 and by the presence of drainage ditches constructed around the coal storage areas are not evident in the 1981 data. These expected changes might occur during 1982 and may become evident in the 1982 data.

Approved:

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APPENDIX A

PRE-OPERATIONAL FUEL STORAGE AREA - GROUNDWATER QUALITY STUDIES - 1979-1981

THUNDER BAY EXTENSION

GROUNDWATER CHARACTERISTICS

1979 - LMC DATA
1980-81 - ONTARIO HYDRO DATA - GROUNDWATERS
1981 - ONTARIO HYDRO DATA - POND WATERS

(Due to unresolved discrepancies in analytic results, data for the June 24, 1980 samples are not included in this summary)

(All values are in mg/L except for pH and conductivity.
- pH values are in pH units at 25°C
- Conductivity values are in mS/m at 25°C)

LOCATION : 01A

TEST	790614	790927
ACID4.5	--	--
AG	<.0050	<.0050
AL	<.050	<.050
ALKHCO3	220.	250.
AS	.0010	.0010
B	.091	.063
BA	.086	.052
BE	<.00050	<.00050
CA	82.	85.
CD	<.10	<.10
CL	67.	87.
CO	<.050	<.050
COND	75.	72.
CR	.030	.010
CU	.065	<.0050
F	--	.13
FE	3.0	7.7
HG	.00007	.00007
K	<1.0	3.0
MG	33.	31.
MN	5.5	7.2
MO	<.20	<.20
NA	17.	28.
NI	<.050	<.050
NO3	.60	<.10
PB	.060	<.050
PH	6.6	6.8
PO4	<.10	<.10
SE	<.0010	<.0010
SI	15.	18.
SN	<.00010	.0080
SO4	4.6	59.
SR	.19	.17
TH*	<.010	<.010
TI	<.0050	<.0050
V	<.0050	<.0050
ZN	.060	<.050
ZR	<.020	<.020

SAMPLING DATE

TEST	800704	800919	810511	810826
ACID4.5	--	--	--	--
AG	<.00030	--	<.00020	--
AL	<.10	--	<.10	--
ALKCO3	--	--	--	--
ALKHCO3	--	470.	290.	220.
ALKTOT	--	--	290.	220.
AS	.0040	--	.0040	--
B	<.0010	--	.30	.040
BA	.35	--	--	--
BE	<.00010	--	<.00010	--
BR	--	--	<.10	--
CA	110.	37.	79.	48.
CD	<.00010	--	<.00010	--
CL	90.	82.	98.	84.
CO	<.10	--	<.050	--
COND	91.	85.	76.	71.
CR	<.0050	--	<.10	--
CU	.011	--	<.0010	--
F	.11	--	.50	--
FE	130.	1.0	4.9	.69
HG	.00005	--	<.00040	--
I	--	--	<.050	--
K	7.5	10.	2.1	--
MG	56.	31.	33.	--
MN	3.0	7.0	1.6	7.8
MO	<.20	--	<.25	--
NA	19.	42.	41.	52.
NI	.0099	--	<.0050	--
NO3	.25	--	<.10	--
PB	<.0020	--	<.0020	--
PH	7.9	6.4	7.5	6.4
PO4	<.10	<.10	.26	.20
SE	<.0010	--	<.0010	--
SI	27.	--	18.	--
SO4	77.	10.	<.10	6.0
SR	.23	--	.13	--
TH	<.040	--	--	--
TI	<.010	--	<1.0	--
V	.011	--	<.0010	--
ZN	.27	--	<.020	--
ZR	<.010	--	--	--

* TH printout error, should read TH

FUEL STORAGE AREA GROUNDWATER MONITORING PROGRAM THUNDER BAY TGS

LOCATION : 04A

TEST	SAMPLING DATE 790614	790927	800704	800919	810511	810826
ACID4.5	--	--	--	--	--	--
AG	<.0050	<.0050	<.00030	--	<.00020	--
AL	<.050	<.050	<.10	--	<.10	--
ALKHCO3	360.	370.	--	--	--	--
AS	.021	.0080	--	320.	440.	350.
B	<.0050	<.0050	--	--	440.	350.
BA	.40	.24	.0040	--	.016	--
BE	<.00050	<.00050	<.0010	--	.30	.35
CA	150.	110.	.13	--	--	--
CD	<.10	<.10	<.00010	--	<.00010	--
CL	55.	76.	--	--	.16	--
CO	<.050	<.050	130.	38.	130.	75.
COND	120.	86.	.00026	--	<.00010	--
CR	.050	.020	72.	30.	31.	75.
CU	<.0050	<.0050	<.10	--	<.050	--
F	--	.15	100.	130.	98.	82.
FE	50.	21.	.016	--	<.10	--
HG	.00001	.00004	.0037	--	<.0010	--
K	<1.0	2.0	.13	--	<.10	--
MG	56.	36.	49.	39.	120.	.24
MN	1.6	.94	.0017	--	<.00040	--
MO	<.20	<.20	--	--	<.050	--
NA	45.	48.	2.1	8.0	3.6	--
NI	<.050	<.050	42.	53.	58.	--
NO3	.60	<.10	1.2	1.0	1.1	.85
PB	<.050	<.050	<.20	--	<.05	--
PH	7.0	7.2	41.	54.	23.	61.
PO4	<.10	<.10	<.0030	--	<.0050	--
SE	<.0010	<.0010	.39	--	<.10	--
SI	21.	19.	.0020	--	<.0020	--
SN	<.00010	<.0020	8.0	6.4	7.1	6.9
SO4	270.	72.	<.10	15.	<.010	.16
SR	.49	.30	<.0010	--	<.0010	--
TH	<.010	<.010	17.	--	14.	--
TI*	<.0050	<.0050	3.5	64.	150.	59.
V	<.0050	<.0050	.27	--	.31	--
ZN	<.050	<.050	<.040	--	--	--
ZR	<.020	<.020	<.010	--	<1.0	--
			.0030	--	.0020	--
			.060	--	<.020	--
			<.010	--	--	--

* 1L printout error, should read TI

FUEL STORAGE AREA GROUNDWATER MONITORING PROGRAM THUNDER BAY TGS

LOCATION : 05C

TEST	SAMPLING DATE 790614	790927	800704	800919	810511	810826
ACID4.5	--	--	--	--	--	--
AG	<.0050	<.0050	<.00030	--	<.00020	--
AL	<.050	<.050	.23	--	.20	--
ALKHCO3	540.	380.	--	--	--	--
AS	.037	.024	.015	--	.011	--
B	<.0050	<.0050	<.0010	--	.10	.060
BA	.64	.61	.35	--	--	--
BE	<.00050	<.00050	<.00010	--	<.00010	--
CA	180.	190.	--	--	.60	--
CD	<.10	<.10	250.	150.	260.	170.
CL	250.	290.	.00018	--	<.00010	--
CO	<.050	<.050	200.	130.	1000.	140.
COND	150.	160.	<.10	--	<.050	--
CR	.070	<.010	210.	350.	280.	140.
CU	.010	<.0050	<.0050	--	<.10	--
F	--	.16	.0047	--	<.0010	--
FE	90.	93.	.13	--	<.10	--
HG	.00001	<.00001	21.	1.0	5.6	3.2
K	<1.0	4.0	.00041	--	<.00040	--
MG	72.	47.	--	--	.17	--
MN	2.5	2.6	4.4	8.0	3.2	--
MO	<.20	<.20	70.	76.	110.	--
NA	53.	49.	2.6	3.0	2.9	3.0
NI	<.050	<.050	<.20	--	<.25	--
NO3	2.2	<.10	44.	170.	130.	59.
PB	<.050	<.050	<.0030	--	<.0050	--
PH	7.1	7.1	<.10	--	<.10	--
PO4	<.10	<.10	.0026	--	<.0020	--
SE	<.0010	<.0010	7.7	7.2	7.3	6.7
SI	22.	20.	<.10	<.10	.046	<.10
SN	<.00010	.0070	<.0010	--	<.0010	--
SO4	2.1	20.	20.	--	15.	--
SR	.42	.40	8.0	9.0	<.10	3.5
TH	<.010	<.010	.35	--	.76	--
TI	<.0050	<.0050	<.040	--	--	--
V	<.0050	.0060	<.010	--	1.6	--
ZN	<.050	<.050	.0059	--	.0040	--
ZR	<.020	<.020	.010	--	<.020	--
			<.010	--	--	--

FUEL STORAGE AREA GROUNDWATER MONITORING PROGRAM THUNDER BAY TGS

LOCATION : 06B

TEST	790614	790927
ACID4.5	--	--
AG	<.0050	<.0050
AL	<.050	<.050
ALKHCO3	400.	310.
AS	.020	.011
B	<.0050	<.0050
BA	.43	.40
BE	<.00050	<.00050
CA	160.	160.
CD	.20	<.10
CL	250.	--
CO	<.050	<.050
COND	150.	130.
CR	.060	.030
CU	<.026	<.0050
F	--	.14
FE	22.	29.
HG	.00003	.00004
K	<1.0	4.0
MG	63.	48.
MN	2.2	2.3
MO	<.20	<.20
NA	39.	37.
NI	<.050	<.050
NO3	2.2	<.10
PB	<.050	<.050
PH	7.5	7.1
PO4	<.10	<.10
SE	<.0010	<.0010
SI	27.	24.
SN	<.00010	.0060
SO4	5.7	5.8
SR	.31	.27
TH	<.010	<.010
TI	<.0050	<.0050
V	<.0050	<.0050
ZN	<.050	<.050
ZR	<.020	<.020

SAMPLING DATE

TEST	800704	800919	810511	810826
ACID4.5	--	--	--	--
AG	<.00030	--	<.00020	--
AL	.52	--	.20	--
ALKCO3	--	-	--	--
ALKHCO3	--	450.	460.	410.
ALKTOT	--	--	460.	410.
AS	.0090	--	.024	--
B	<.0010	--	.20	.070
BA	.30	--	--	--
BE	<.00010	--	<.00010	--
BR	--	--	.20	--
CA	200.	100.	170.	140.
CD	<.00010	--	<.00010	--
CL	230.	320.	250.	160.
CO	<.10	--	<.050	--
COND	160.	160.	140.	120.
CR	.010	--	<.10	--
CU	.0037	--	<.0010	--
F	.10	--	<.10	--
FE	18.	8.0	14.	.50
HG	.00020	--	<.00040	--
I	--	--	.030	--
K	4.3	6.0	2.8	--
MG	57.	54.	56.	--
MN	2.2	2.0	1.7	2.2
MO	<.20	--	<.25	--
NA	37.	33.	40.	45.
NI	<.0030	--	<.0050	--
NO3	<.10	--	<.10	--
PB	.0040	--	<.0020	--
PH	7.7	7.0	7.5	6.8
PO4	<.10	<.10	.028	.16
SE	<.0010	--	<.0010	--
SI	25.	--	20.	--
SO4	1.1	9.0	<.10	2.8
SR	.30	--	.24	--
TH	<.040	--	--	--
TI	<.010	--	<1.0	--
V	<.0050	--	<.0010	--
ZN	.030	--	<.020	--
ZR	<.010	--	--	--

FUEL STORAGE AREA GROUNDWATER MONITORING PROGRAM THUNDER BAY TGS

LOCATION : 06C

TEST	790614	790927	800704	800919	810511	810826
			SAMPLING DATE			
ACID4.5	--	--	--	--	--	--
AG	<.0050	<.0050	<.00030	--	<.00020	--
AL	<.050	<.050	.38	--	.10	--
ALKHCO3	800.	730.	--	--	--	1.0
AS	.031	.016	--	390.	370.	340.
B	<.0050	<.0050	--	--	370.	340.
BA	.91	.57	.0020	--	.0080	--
BE	<.00050	<.00050	<.0010	--	.20	.090
CA	220.	210.	.29	--	--	--
CD	.20	.30	<.00010	--	<.00010	--
CL	120.	210.	--	--	2.0	--
CO	<.050	<.050	160.	88.	130.	97.
COND	170.	160.	.00016	--	<.00010	--
CR	.090	.010	230.	130.	250.	150.
CU	<.0050	<.0050	<.10	--	<.050	--
F	--	.20	150.	140.	130.	100.
FE	130.	98.	.010	--	<.10	--
HG	.00001	.00017	.014	--	<.0010	--
K	<1.0	3.0	<.050	--	<.10	--
MG	94.	75.	4.8	1.0	.40	.23
MN	2.2	2.2	.00021	--	.00040	--
MO	.70	<.20	--	--	.030	--
NA	29.	30.	3.3	6.0	2.4	--
NI	<.050	<.050	64.	48.	51.	--
NO3	1.1	<.10	2.0	2.0	.60	1.8
PB	<.050	<.050	<.20	--	<.25	--
PH	7.0	6.8	55.	54.	52.	54.
PO4	<.10	<.10	<.0030	--	<.0050	--
SE	<.0010	<.0010	<.10	--	<.10	--
SI	29.	24.	<.0020	--	<.0020	--
SN	<.00010	<.0020	7.7	7.5	7.6	7.4
SO4	2.0	9.7	<.10	<.10	.039	.16
SR	.51	.43	<.0010	--	<.0010	--
TH	<.010	<.010	23.	--	21.	--
TI	<.0050	<.0050	1.0	9.0	<.10	2.5
V	<.0050	<.0050	.25	--	.29	--
ZN	<.050	<.050	<.040	--	--	--
ZR	<.020	<.020	<.010	--	<1.0	--
			<.0030	--	<.0010	--
			.020	--	<.020	--
			<.010	--	--	--

FUEL STORAGE AREA GROUNDWATER MONITORING PROGRAM THUNDER BAY TGS

LOCATION : 07B

TEST	790614	790927
ACID4.5	--	--
AG	<.0050	<.0050
AL	<.050	<.050
ALKHCO3	330.	350.
AS	.011	.0040
B	.063	.050
BA	.26	.23
BE	<.00050	<.00050
CA	110.	110.
CD	<.10	<.10
CL	54.	70.
CO	<.050	<.050
COND	79.	75.
CR	.050	<.010
CU	.012	<.0050
F	--	.11
FE	23.	23.
HG	.00001	.00013
K	<1.0	1.0
MG	42.	36.
MN	1.7	1.7
MO	<.20	<.20
NA	17.	18.
NI	<.050	<.050
NO3	.50	<.10
PB	.050	<.050
PH	7.5	7.1
PO4	<.10	<.10
SE	<.0010	<.0010
SI	31.	28.
SN	<.00010	.0040
SO4	43.	47.
SR	.23	.20
TH	<.010	<.010
TI	<.0050	<.0050
V	<.0050	<.0050
ZN	<.050	<.050
ZR	<.020	<.020

SAMPLING DATE

TEST	800704	800919	810511	810826
ACID4.5	--	--	--	--
AG	<.00030	--	--	--
AL	<.10	--	--	--
ALKCO3	--	--	--	--
ALKHCO3	--	220.	390.	360.
ALKTOT	--	--	390.	360.
AS	.0020	--	--	--
B	<.0010	--	.30	--
BA	.10	--	--	--
BE	<.00010	--	--	--
BR	--	--	--	--
CA	140.	23.	--	72.
CD	.00016	--	--	--
CL	75.	46.	85.	88.
CO	<.10	--	--	--
COND	100.	98.	88.	77.
CR	.013	--	--	--
CU	.0042	--	--	--
F	.30	--	<.10	--
FE	1.9	6.0	--	.25
HG	.00010	--	--	--
I	--	--	--	--
K	3.3	9.0	--	--
MG	47.	29.	--	--
MN	1.7	2.0	--	1.8
MO	<.20	--	--	--
NA	16.	20.	--	26.
NI	<.0030	--	--	--
NO3	<.10	--	<.10	--
PB	.0040	--	--	--
PH	7.5	7.1	7.0	7.0
PO4	<.10	3.0	.15	.16
SE	<.0010	--	--	--
SI	26.	--	22.	--
SO4	27.	11.	5.1	--
SR	.19	--	--	--
TH	<.040	--	--	--
TI	<.010	--	--	--
V	<.0030	--	--	--
ZN	.020	--	--	--
ZR	<.010	--	--	--

FUEL STORAGE AREA GROUNDWATER MONITORING PROGRAM THUNDER BAY TGS

LOCATION : 08B

TEST	SAMPLING DATE 790614	790927	800704	800919	810511	810826
ACID4.5	--	--	--	--	--	--
AG	<.0050	<.0050	<.00030	--	<.00020	--
AL	<.050	<.50	.35	--	4.4	--
ALKHCO3	240.	160.	--	--	--	--
AS	.012	.014	--	--	36.	63.
B	2.3	2.8	--	--	36.	63.
BA	.38	.24	.0020	--	.015	--
BE	<.00050	<.00050	4.2	--	2.2	--
CA	110.	86.	.35	--	--	--
CD	.20	<.10	<.00010	--	<.00010	--
CL	16.	27.	--	--	.20	--
CO	<.050	<.050	170.	--	120.	71.
COND	69.	68.	<.00010	--	<.00010	--
CR	.030	<.010	35.	--	39.	44.
CU	.024	<.0050	<.10	--	<.050	--
F	--	.26	97.	--	93.	84.
FE	52.	34.	<.0050	--	<.10	--
HG	.00003	<.00001	.0052	--	<.0010	--
K	<1.0	3.0	.30	--	<.10	--
MG	21.	15.	39.	--	37.	1.7
MN	1.4	1.1	.00015	--	.0010	--
MO	<.20	<.20	--	--	<.050	--
NA	22.	23.	8.1	--	4.4	--
NI	<.050	<.050	21.	--	17.	--
NO3	.20	<.10	1.7	--	1.7	1.4
PB	<.050	<.050	<.20	--	<.05	--
PH	7.2	6.7	23.	--	50.	80.
PO4	<.10	<.10	<.0030	--	<.0050	--
SE	<.0010	<.0010	.20	--	<.10	--
SI	20.	19.	<.0020	--	<.0020	--
SN	<.00010	.0040	6.5	--	6.1	6.8
SO4	130.	160.	<.10	--	<.030	<.10
SR	1.5	.89	<.0010	--	<.0010	--
TH	<.010	<.010	17.	--	11.	--
TI	<.0050	<.0050	340.	--	420.	250.
V	<.0050	<.0050	1.5	--	1.4	--
ZN	<.050	<.050	<.040	--	--	--
ZR	<.020	<.020	<.010	--	1.0	--
			.0030	--	.0050	--
			.030	--	<.020	--
			--	--	--	--

FUEL STORAGE AREA GROUNDWATER MONITORING PROGRAM THUNDER BAY TGS

LOCATION : 10B

TEST	SAMPLING DATE 790614	790927	800704	800919	810511	810826
ACID4.5	--	--	--	--	--	--
AG	<.0050	<.0050	<.00030	--	--	--
AL	<.050	<.050	.39	--	--	--
ALKHCO3	210.	250.	--	--	--	--
AS	.026	.011	--	180.	--	--
B	2.7	2.1	--	--	--	--
BA	.24	.23	.0060	--	--	--
BE	<.00050	<.00050	3.0	--	--	--
CA	96.	86.	.27	--	--	--
CD	<.10	<.10	<.00010	--	--	--
CL	20.	35.	--	--	--	--
CO	<.050	<.050	120.	30.	--	--
COND	76.	76.	.00010	--	--	--
CR	.040	<.010	42.	24.	--	--
CU	.027	<.0050	<.10	--	--	--
F	--	.12	78.	100.	--	--
FE	130.	130.	<.0050	--	--	--
HG	.00032	<.00001	.0043	--	--	--
K	1.0	<1.0	.50	--	--	--
MG	28.	24.	120.	41.	--	--
MN	3.0	2.9	.00021	--	--	--
MO	.20	<.20	--	--	--	--
NA	19.	17.	2.8	6.0	--	--
NI	<.050	<.050	26.	24.	--	--
NO3	.30	<.10	3.6	2.0	--	--
PB	<.050	<.050	<.20	--	--	--
PH	6.6	6.4	19.	23.	--	--
PO4	<.10	<.10	.014	--	--	--
SE	<.0010	<.0010	<.10	--	--	--
SI	29.	28.	.0020	--	--	--
SN	<.00010	.0040	6.6	6.6	--	--
SO4	240.	59.	<.10	<.10	--	--
SR	.70	.49	<.0010	--	--	--
TH	<.010	<.010	27.	--	--	--
TI	<.0050	<.0050	110.	77.	--	--
V	.011	<.0050	.59	--	--	--
ZN	<.050	<.050	<.040	--	--	--
ZR	<.020	<.020	<.010	--	--	--
			.0020	--	--	--
			.050	--	--	--
			--	--	--	--

FUEL STORAGE AREA GROUNDWATER MONITORING PROGRAM THUNDER BAY IGS

LOCATION : 10C

TEST	790614	790927	800704	800919	810511	810826
			SAMPLING DATE			
ACID4.5	--	--	--	--	--	--
AG	<.0050	<.0050	<.00030	--	--	--
AL	<.050	<.050	<.10	--	--	--
ALKHCO3	230.	360.	--	--	--	--
AS	.050	.023	--	540.	--	--
B	6.3	5.1	--	--	--	--
BA	.30	.36	.0050	--	--	--
BE	<.00050	<.00050	<1.0	--	--	--
CA	160.	140.	.35	--	--	--
CD	.40	<.10	<.00010	--	--	--
CL	26.	28.	--	--	--	--
CO	<.050	<.050	190.	78.	--	--
COND	110.	100.	<.00010	--	--	--
CR	.040	<.010	160.	94.	--	--
CU	<.0050	<.0050	<.10	--	--	--
F	--	.26	150.	150.	--	--
FE	71.	80.	<.0050	--	--	--
HG	.00022	<.00001	.0048	--	--	--
K	4.0	3.0	.65	--	--	--
MG	32.	26.	110.	12.	--	--
MN	4.6	4.8	.00016	--	--	--
MO	.50	<.20	--	--	--	--
NA	23.	21.	5.5	6.0	--	--
NI	<.050	<.050	31.	61.	--	--
NO3	.30	<.10	6.1	1.0	--	--
PB	<.050	<.050	<.20	--	--	--
PH	6.7	6.7	24.	45.	--	--
PO4	<.10	<.10	.024	--	--	--
SE	<.0010	<.0010	<.10	--	--	--
SI	17.	19.	<.0020	--	--	--
SN	<.00010	.0020	7.2	7.0	--	--
SO4	430.	140.	<.10	3.0	--	--
SR	2.5	2.0	<.0010	--	--	--
TH	<.010	<.010	17.	--	--	--
TI	<.0050	<.0050	28.	9.0	--	--
V	<.0050	<.0050	1.8	--	--	--
ZN	<.050	<.050	<.040	--	--	--
ZR	<.020	<.020	<.010	--	--	--
			.0040	--	--	--
			.040	--	--	--
			--	--	--	--

FUEL STORAGE AREA GROUNDWATER MONITORING PROGRAM - THUNDER BAY TGS

LOCATION : 12C

TEST	790614	790927	800704	800919	810511	810826
			SAMPLING DATE			
ACID4.5	--	54.	--	--	--	--
AG	<.0050	<.0050	<.00030	--	<.00020	--
AL	.18	<.050	<.10	--	.10	--
ALKHCO3	84.	--	--	--	--	--
AS	.0016	<.0010	--	--	--	--
B	4.5	3.2	--	--	--	--
BA	.054	<.0050	--	--	--	--
BE	<.00050	<.00050	--	--	--	--
CA	530.	580.	--	--	--	--
CD	.20	<.10	--	--	--	--
CL	50.	60.	--	--	--	--
CO	.31	.88	--	--	--	--
COND	280.	420.	--	--	--	--
CR	.11	.030	--	--	--	--
CU	.019	.010	--	--	--	--
F	--	.93	--	--	--	--
FE	12.	99.	--	--	--	--
HG	.00075	.0015	--	--	--	--
K	6.0	20.	--	--	--	--
MG	170.	230.	--	--	--	--
MN	110.	180.	--	--	--	--
MO	.40	<.20	--	--	--	--
NA	52.	63.	--	--	--	--
NI	.25	.70	--	--	--	--
NO3	<1.0	<1.0	--	--	--	--
PB	<.050	<.050	--	--	--	--
PH	6.0	2.8	--	--	--	--
PO4	<.10	<.10	--	--	--	--
SE	<.0010	<.0010	--	--	--	--
SI	15.	23.	--	--	--	--
SN	<.00010	.0060	--	--	--	--
SO4	2500.	3100.	--	--	--	--
SR	2.6	2.4	--	--	--	--
TH	.020	.020	--	--	--	--
TI	<.0050	<.0050	--	--	--	--
V	.0060	.017	--	--	--	--
ZN	.29	1.3	--	--	--	--
ZR	<.020	<.020	--	--	--	--

TEST	800704	800919	810511	810826
	SAMPLING DATE			
ACID4.5	--	--	--	--
AG	<.00030	--	<.00020	--
AL	<.10	--	.10	--
ALKCO3	--	--	--	--
ALKHCO3	--	140.	72.	10.
ALKTOT	--	--	72.	10.
AS	<.0010	--	.0060	--
B	2.3	--	1.2	--
BA	.030	--	--	--
BE	<.00020	--	.00040	--
BR	--	--	.40	--
CA	180.	60.	77.	24.
CD	.0013	--	.00070	--
CL	28.	43.	17.	16.
CO	.18	--	.10	--
COND	130.	220.	70.	41.
CR	--	--	<.10	--
CU	.0024	--	<.0010	--
F	.24	--	--	--
FE	36.	26.	32.	5.9
HG	.00050	--	<.00040	--
I	--	--	<.050	--
K	6.4	14.	3.0	--
MG	45.	75.	22.	--
MN	3.3	3.0	12.	8.0
MO	<.20	--	<.25	--
NA	22.	29.	20.	17.
NI	.24	--	.20	--
NO3	<.10	--	<.10	--
PB	<.0020	--	<.0020	--
PH	6.2	7.2	5.9	5.6
PO4	<.10	5.0	.38	<.10
SE	<.0010	--	<.0010	--
SI	19.	--	13.	--
SO4	630.	620.	--	100.
SR	.71	--	.38	--
TH	<.040	--	--	--
TI	<.010	--	<1.0	--
V	.0050	--	.0060	--
ZN	.38	--	.21	--
ZR	--	--	--	--

FUEL STORAGE AREA GROUNDWATER MONITORING PROGRAM THUNDER BAY TGS

LOCATION : 13B

TEST	790614	790927	SAMPLING DATE 800704	800919	810511	810826
ACID4.5	--	94.	--	340.	--	--
AG	.0060	<.0050	<.00030	--	<.00020	--
AL	.090	<.050	.59	--	16.	--
ALKHCO3	4.0	--	--	--	--	--
AS	.016	.0050	--	--	--	8.0
B	2.4	1.9	--	--	--	8.0
BA	.11	.055	.0020	--	<.0010	--
BE	<.00050	<.00050	4.4	--	3.2	--
CA	480.	490.	.050	--	--	--
CD	.40	<.10	.00070	--	.054	--
CL	54.	81.	--	--	<.10	--
CO	1.3	.95	410.	210.	300.	450.
COND	410.	520.	.0020	--	.010	--
CR	.17	<.010	37.	17.	26.	33.
CU	.031	<.0050	.87	--	.66	--
F	--	1.0	400.	460.	290.	320.
FE	340.	380.	<.0050	--	.10	--
HG	<.00001	<.00001	.0075	--	.11	--
K	21.	25.	.87	--	1.8	--
MG	250.	240.	490.	330.	400.	8.2
MN	140.	150.	.00015	--	.00040	--
MO	.60	<.20	--	--	.10	--
NA	240.	200.	14.	12.	12.	--
NI	.79	.55	190.	160.	120.	--
NO3	<1.0	<1.0	150.	110.	54.	8.7
PB	<.050	<.050	<.20	--	<.25	--
PH	5.2	5.0	86.	120.	69.	100.
PO4	<.10	<.10	.53	--	1.5	--
SE	<.0010	<.0010	<.10	--	<.10	--
SI	38.	35.	<.0020	--	<.0020	--
SN	<.00010	<.0020	4.9	6.3	3.9	5.9
SO4	4200.	3800.	<.10	3.0	.040	.80
SR	1.7	1.2	<.0010	--	<.0010	--
TH	.050	<.010	33.	--	33.	--
TI	<.0050	<.0050	2700.	1400.	2300.	2600.
V	.027	.037	1.1	--	1.0	--
ZN	.13	<.050	<.040	--	--	--
ZR	<.020	<.020	<.010	--	<1.0	--
			.022	--	<.0010	--
			.39	--	1.5	--
			<.010	--	--	--

FUEL STORAGE AREA GROUNDWATER MONITORING PROGRAM THUNDER BAY TGS

LOCATION : 13C

TEST	790614	790927
ACID4.5	22.	540.
AG	.0050	<.0050
AL	3.6	16.
ALKHCO3	--	--
AS	.0012	<.0010
B	2.6	1.8
BA	.067	<.0050
BE	<.00050	.022
CA	590.	510.
CD	.20	.30
CL	63.	93.
CO	1.8	2.2
COND	380.	570.
CR	.16	<.010
CU	.021	<.0050
F	--	4.4
FE	150.	480.
HG	.00018	.00056
K	22.	33.
MG	290.	290.
MN	160.	190.
MO	.60	<.20
NA	210.	190.
NI	1.2	1.6
NO3	<1.0	<1.0
PB	<.050	<.050
PH	3.6	2.5
PO4	<.10	<.10
SE	<.0010	<.0010
SI	32.	37.
SN	<.00010	<.0020
SO4	3900.	4400.
SR	2.2	1.7
TH	.040	.020
TI	.0080	<.0050
V	.023	.047
ZN	1.5	2.3
ZR	<.020	<.020

SAMPLING DATE

TEST	800704	800919	810511	810826
ACID4.5	--	320.	--	--
AG	<.00030	--	<.00020	--
AL	21.	--	.20	--
ALKCO3	--	--	--	--
ALKHCO3	--	--	--	14.
ALKTOT	--	--	--	14.
AS	<.0010	--	<.0010	--
B	4.4	--	3.2	--
BA	.010	--	--	--
BE	.032	--	<.00010	--
BR	--	--	<.10	--
CA	340.	310.	370.	350.
CD	.0049	--	<.00010	--
CL	40.	19.	33.	30.
CO	.91	--	.50	--
COND	410.	660.	330.	300.
CR	<.0050	--	.20	--
CU	.023	--	<.0010	--
F	2.6	--	1.7	--
FE	430.	920.	500.	8.1
HG	.00010	--	.00040	--
I	--	--	<.050	--
K	16.	14.	9.0	--
MG	150.	220.	150.	--
MN	130.	140.	83.	85.
MO	<.20	--	<.25	--
NA	55.	150.	80.	110.
NI	1.4	--	.60	--
NO3	<.10	--	<.10	--
PB	<.0020	--	<.0020	--
PH	4.1	4.2	4.2	6.1
PO4	<.10	13.	.38	<.10
SE	<.0010	--	<.0010	--
SI	38.	--	29.	--
SO4	3000.	1400.	2700.	2200.
SR	1.1	--	.98	--
TH	<.040	--	--	--
TI	<.010	--	<1.0	--
V	.018	--	.0070	--
ZN	1.4	--	.60	--
ZR	.015	--	--	--

FUEL STORAGE AREA GROUNDWATER MONITORING PROGRAM THUNDER BAY TGS

LOCATION : 14A

SAMPLING DATE

TEST	790614	790927	800704	800919	810511	810826
ACID4.5	--	--	--	44.	--	--
AG	.0070	<.0050	<.00030	--	.00020	--
AL	<.050	<.050	1.4	--	<.20	--
ALKHCO3	16.	--	--	--	--	--
AS	.0092	.0020	--	--	--	--
B	<.0050	<.0050	--	--	--	20.
BA	.061	.042	--	--	--	20.
BE	<.00050	<.00050	.0020	--	.011	--
CA	260.	240.	.79	--	<.10	--
CD	.40	.30	.030	--	--	--
CL	58.	75.	.00010	--	<.00010	--
CO	.10	<.050	--	--	<.20	--
COND	360.	400.	280.	150.	390.	300.
CR	.13	<.010	<.00030	--	<.00010	--
CU	.054	<.0050	70.	41.	76.	66.
F	--	2.0	<.10	--	<.050	--
FE	580.	630.	400.	440.	420.	330.
HG	<.00001	.00024	<.0050	--	.20	--
K	10.	10.	.0024	--	.0010	--
MG	200.	180.	.66	--	.80	--
MN	46.	50.	540.	420.	670.	8.2
MO	.70	<.20	.00011	--	.00060	--
NA	200.	170.	--	--	<.050	--
NI	.080	.070	5.5	8.0	3.4	--
NO3	<1.0	<1.0	180.	140.	230.	--
PB	<.050	<.050	56.	52.	66.	51.
PH	5.4	5.1	<.20	--	<.25	--
PO4	<.10	<.10	190.	210.	200.	220.
SE	<.0010	<.0010	.015	--	<.0050	--
SI	30.	28.	<.10	--	<.10	--
SN	<.00010	<.0020	.0056	--	<.0020	--
SO4	3300.	3100.	4.9	6.5	4.3	6.3
SR	.44	.35	<.10	13.	.16	<.10
TH	.080	<.010	<.0010	--	<.0010	--
TI	<.0050	<.0050	27.	--	24.	--
V	.040	.050	2700.	1300.	3400.	2200.
ZN	.11	<.050	.32	--	.49	--
ZR	<.020	<.020	<.040	--	--	--
			<.010	--	<1.0	--
			.024	--	<.0050	--
			.080	--	.020	--
			<.020	--	--	--

FUEL STORAGE AREA GROUNDWATER MONITORING PROGRAM THUNDER BAY TGS

LOCATION : 14B

TEST	SAMPLING DATE 790614	790927
ACID4.5	--	68.
AG	<.0050	<.0050
AL	<.050	<.050
ALKHCO3	44.	--
AS	.0042	<.0010
B	1.4	1.5
BA	.073	.026
BE	<.00050	.00050
CA	300.	300.
CD	.30	<.10
CL	33.	44.
CO	<.050	<.050
COND	370.	500.
CR	.14	<.010
CU	<.0050	<.0050
F	--	.59
FE	400.	360.
HG	<.00001	.00004
K	7.0	10.
MG	170.	59.
MN	25.	25.
MO	.60	<.20
NA	480.	550.
NI	.060	.080
NO3	<1.0	<1.0
PB	<.050	<.050
PH	6.0	5.5
PO4	<.10	<.10
SE	<.0010	<.0010
SI	26.	25.
SR	<.00010	<.0020
SO4	3800.	3400.
SX	.62	.51
TH	<.010	.020
TI	<.0050	<.0050
V	.025	.039
ZN	.11	<.050
ZR	<.020	<.020

TEST	SAMPLING DATE 800704	800919	810511	810826
ACID4.5	--	--	--	--
AG	.00050	--	.00020	--
AL	1.5	--	<.10	--
ALKCO3	--	--	--	--
ALKHCO3	--	10.	--	31.
ALKTOT	--	--	--	31.
AS	.0010	--	<.0010	--
B	1.1	--	1.1	--
BA	.020	--	--	--
BE	.00010	--	<.00010	--
BR	--	--	1.1	--
CA	290.	150.	400.	270.
CD	<.00010	--	<.00010	--
CL	40.	15.	60.	48.
CO	.14	--	<.050	--
COND	470.	490.	440.	360.
CR	<.0050	--	.20	--
CU	.0010	--	<.0010	--
F	.22	--	<.10	--
FE	330.	140.	330.	7.9
HG	.00016	--	<.00040	--
I	--	--	<.050	--
K	5.4	8.0	5.2	--
MG	160.	110.	180.	--
MN	36.	33.	41.	40.
MO	.62	--	<.25	--
NA	420.	480.	460.	4000.
NI	<.0030	--	<.0050	--
NO3	<.10	--	<.10	--
PB	<.0020	--	<.0020	--
PH	5.4	6.4	5.0	6.1
PO4	<.10	25.	.024	<.10
SE	<.0010	--	<.0010	--
SI	24.	--	20.	--
SO4	2900.	1200.	3400.	2709.
SR	.28	--	.65	--
TH	.035	--	--	--
TI	<.010	--	<1.0	--
V	.017	--	<.0010	--
ZN	.030	--	.030	--
ZR	.013	--	--	--

FUEL STORAGE AREA GROUNDWATER MONITORING PROGRAM THUNDER BAY TGS

LOCATION : 14C

TEST	790614	790927
ACID4.5	--	--
AG	<.0050	<.0050
AL	<.050	<.050
ALKHCO3	88.	88.
AS	.0012	.0010
B	2.1	2.0
BA	.058	.015
BE	<.00050	<.00050
CA	210.	200.
CD	.10	<.10
CL	18.	22.
CO	<.050	<.050
COND	240.	300.
CR	.070	.020
CU	.0050	<.0050
F	--	.78
FE	120.	150.
HG	.00003	.00018
K	6.0	7.0
MG	74.	48.
MN	10.	11.
MO	.60	<.20
NA	360.	390.
NI	<.050	.050
NO3	<1.0	<1.0
PB	.060	<.050
PH	6.3	5.7
PO4	<.10	<.10
SE	<.0010	<.0010
SI	20.	21.
SN	<.00010	<.0020
SO4	2000.	1700.
SR	.76	.54
TH	<.010	<.010
TI	<.0050	<.0050
V	.0070	.019
ZN	.040	<.020
ZR	<.020	<.020

SAMPLING DATE

TEST	800704	800919	810511	810826
ACID4.5	--	--	--	--
AG	.00040	--	.00030	--
AL	.27	--	.10	--
ALKCO3	--	--	--	--
ALKHCO3	--	55.	10.	51.
ALKTOT	--	--	10.	51.
AS	<.0010	--	.011	--
B	2.9	--	1.5	--
BA	.030	--	--	--
BE	<.00010	--	<.00010	--
BR	--	--	.30	--
CA	290.	100.	350.	200.
CD	<.00010	--	<.00010	--
CL	55.	34.	48.	28.
CO	<.10	--	<.050	--
COND	390.	450.	350.	280.
CR	<.0050	--	.10	--
CU	.0016	--	<.0010	--
F	1.3	--	<.10	--
FE	270.	79.	200.	6.9
HG	.00010	--	<.00040	--
I	--	--	<.050	--
K	4.8	7.0	3.8	--
MG	89.	73.	110.	--
MN	13.	13.	12.	12.
MO	<.20	--	<.25	--
NA	430.	530.	430.	650.
NI	.0040	--	<.0050	--
NO3	<.10	--	<.10	--
PB	<.0020	--	<.0020	--
PH	5.4	6.6	5.1	6.4
PO4	<.10	<.10	.32	<.10
SE	<.0010	--	<.0010	--
SI	19.	--	12.	--
SO4	2200.	1900.	2400.	1500.
SR	.27	--	.55	--
TH	<.040	--	--	--
TI	<.010	--	<1.0	--
V	.015	--	.0050	--
ZN	.030	--	.020	--
ZR	<.010	--	--	--

FUEL STORAGE AREA GROUNDWATER MONITORING PROGRAM 1980-81 THUNDER BAY TGS

LOCATION : 15A

TEST	SAMPLING DATE 800704	800919	810511	810826
ACID.5	--	--	--	--
AG	<.00030	--	<.00020	--
AL	.77	--	.20	--
ALKCO3	--	--	--	--
ALKHCO3	--	540.	930.	590.
ALKTOT	--	--	930.	590.
AS	<.0010	--	<.0010	--
B	<.0010	--	.40	--
BA	.13	--	--	--
BE	<.00010	--	<.00010	--
BR	--	--	.70	--
CA	240.	30.	190.	140.
CD	.00010	--	<.00010	--
CL	60.	32.	32.	32.
CO	<.10	--	<.050	--
COND	180.	280.	140.	150.
CR	.017	--	<.10	--
CU	.0052	--	<.0010	--
F	.33	--	<.10	--
FE	16.	14.	91.	2.7
HG	.0019	--	<.00040	--
I	--	--	<.050	--
K	12.	12.	6.0	--
MG	130.	64.	65.	--
MN	11.	14.	16.	--
MO	<.20	--	<.25	--
NA	22.	99.	26.	29.
NI	.049	--	.0090	--
NO3	<.10	--	<.10	--
PB	<.0020	--	<.0020	--
PH	7.8	6.8	7.1	6.5
PO4	<.10	<.10	.046	<.10
SE	<.0010	--	<.0010	--
SI	15.	--	12.	--
SO4	40.	210.	21.	150.
SR	.32	--	.37	--
TH	<.050	--	--	--
TI	<.010	--	<1.0	--
V	.0050	--	<.0050	--
ZN	.32	--	.070	--
ZR	<.010	--	--	--

FUEL STORAGE AREA GROUNDWATER MONITORING PROGRAM 1980-81 THUNDER BAY TGS

LOCATION : 15B

TEST	800704	800919	810511	810826
		SAMPLING DATE		
ACID4.5	--	--	--	--
AG	<.00030	--	<.00020	--
AL	.60	--	.50	--
ALKCO3	--	--	--	--
ALKHCO3	--	700.	61.	670.
ALKTOT	--	--	61.	670.
AS	.0020	--	<.0010	--
B	<.0010	--	.40	--
BA	.35	--	--	--
BE	<.00010	--	<.00010	--
BR	--	--	.30	--
CA	160.	56.	190.	160.
CD	<.00010	--	<.00010	--
CL	77.	53.	95.	39.
CO	<.10	--	<.050	--
COND	140.	170.	130.	130.
CR	<.0050	--	<.10	--
CU	.0020	--	<.0010	--
F	.20	--	<.10	--
FE	94.	150.	87.	.68
HG	.00035	--	<.00040	--
I	--	--	<.050	--
K	6.1	6.0	6.0	--
MG	51.	64.	70.	--
MN	5.6	6.0	4.6	4.4
MO	<.20	--	<.25	--
NA	68.	31.	23.	30.
NI	.015	--	<.0050	--
NO3	<.10	--	<.10	--
PB	<.0020	--	<.0020	--
PH	7.3	7.0	7.5	6.8
PO4	<.10	<.10	.012	<.10
SE	<.0010	--	.0070	--
SI	23.	--	13.	--
SO4	30.	21.	<.10	24.
SR	.34	--	.41	--
TH	<.040	--	--	--
TI	<.010	--	<1.0	--
V	.0030	--	.0040	--
ZN	.34	--	.020	--
ZR	<.010	--	--	--

FUEL STORAGE AREA GROUNDWATER MONITORING PROGRAM 1980-81 THUNDER BAY TCS

LOCATION : 16A

TEST	800704	800919	810511	810826
	SAMPLING DATE			
ACIDITY	--	--	--	--
AG	<.00030	--	<.00020	--
AL	.23	--	.30	--
ALKCO3	--	--	--	--
ALKHCO3	--	660.	440.	490.
ALKTOT	--	--	440.	490.
AS	--	--	<.0010	--
B	<.0010	--	.40	--
BA	.34	--	--	--
BE	<.00010	--	<.00010	--
BR	--	--	.10	--
CA	100.	38.	77.	43.
CD	.00060	--	<.00010	--
CL	36.	34.	33.	28.
CO	<.10	--	<.050	--
COND	110.	170.	79.	110.
CR	<.0050	--	<.10	--
CU	.0026	--	<.0010	--
F	.26	--	<.10	--
FE	5.9	64.	140.	1.1
HG	.00028	--	<.00040	--
I	--	--	<.050	--
K	2.1	9.0	4.8	--
MG	46.	56.	47.	--
MN	8.1	2.0	1.4	1.3
MO	<.20	--	<.25	--
NA	62.	76.	23.	37.
NI	.0090	--	<.0050	--
NO3	<.10	--	<.10	--
PB	<.0020	--	<.0020	--
PH	6.6	6.8	6.6	7.0
PO4	<.10	<.10	.046	<.10
SE	--	--	.0040	--
SI	18.	--	14.	--
SO4	28.	14.	<.10	28.
SR	.13	--	.17	--
TH	<.040	--	--	--
TI	<.010	--	<1.0	--
V	.0050	--	.010	--
ZN	.010	--	.020	--
ZR	<.010	--	--	--

FUEL STORAGE AREA GROUNDWATER MONITORING PROGRAM 1980-81 THUNDER BAY TGS

LOCATION : 16B

TEST	800704	800919	810511	810826
		SAMPLING DATE		
ACID4.5	--	--	--	--
AG	<.00030	--	<.00020	--
AL	.21	--	.20	--
ALKCO3	--	--	--	--
ALKHCO3	--	810.	770.	680.
ALKTOT	--	--	770.	680.
AS	.0050	--	.0010	--
B	<.0010	--	.40	--
BA	.41	--	--	--
BE	<.00010	--	<.00010	--
BR	--	--	.20	--
CA	280.	67.	240.	190.
CD	<.00010	--	<.00010	--
CL	140.	90.	160.	71.
CO	<.10	--	<.050	--
COND	180.	180.	150.	140.
CR	.010	--	<.10	--
CU	.0016	--	<.0010	--
F	.30	--	<.10	--
FE	36.	17.	68.	.50
HG	.0024	--	<.00040	--
I	--	--	<.050	--
K	4.7	6.0	2.0	--
MG	66.	73.	84.	--
MN	3.7	4.0	2.8	2.8
MO	<.20	--	<.25	--
NA	37.	34.	32.	31.
NI	<.0030	--	<.0050	--
NO3	<.10	--	<.10	--
PB	<.0020	--	<.0020	--
PH	7.2	7.3	6.9	6.7
PO4	<.10	<.10	.046	<.10
SE	<.0010	--	<.0010	--
SI	22.	--	16.	--
SO4	23.	23.	8.6	16.
SR	.42	--	.38	--
TH	<.010	--	--	--
TI	<.010	--	1.0	--
V	<.050	--	.060	--
ZN	.15	--	.19	--
ZR	<.010	--	--	--

FUEL STORAGE AREA GROUNDWATER MONITORING PROGRAM 1980-81 THUNDER BAY TGS

LOCATION : 17A

TEST	800704	800919	810511	810826
			SAMPLING DATE	
ACIDITY	--	--	--	--
AG	<.00030	--	<.00020	--
AL	.55	--	<.20	--
ALKCO3	--	--	--	--
ALKHCO3	--	630.	710.	970.
ALKTOT	--	--	710.	970.
AS	.0060	--	<.0010	--
B	<.018	--	.70	--
BA	.17	--	--	--
BE	<.00010	--	<.00010	--
BR	--	--	<.20	--
CA	140.	53.	130.	60.
CD	<.00010	--	<.00010	--
CL	90.	53.	86.	29.
CO	<.10	--	<.050	--
COND	150.	280.	140.	160.
CR	<.0050	--	<.10	--
CU	.0012	--	<.0010	--
F	.30	--	<.10	--
FE	140.	76.	180.	1.5
HG	.0023	--	<.00040	--
I	--	--	<.050	--
K	14.	15.	16.	--
MG	69.	53.	62.	--
MN	4.3	4.0	3.7	3.0
MO	<.20	--	<.25	--
NA	34.	210.	76.	300.
NI	.013	--	<.0050	--
NO3	.70	--	<.10	--
PB	<.0020	--	<.0020	--
PH	7.0	6.8	6.7	6.5
P04	<.10	<.10	.061	<.10
SE	<.0010	--	.0010	--
SI	23.	--	12.	--
SO4	24.	150.	3.8	32.
SR	.26	--	.35	--
TH	<.040	--	--	--
TI	<.010	--	<1.0	--
V	.0030	--	<.0050	--
ZN	.37	--	.030	--
ZR	<.010	--	--	--

FUEL STORAGE AREA GROUNDWATER MONITORING PROGRAM 1980-81 THUNDER BAY TCS

LOCATION : 17B

TEST	800704	800919	810511	810826
ACIDW.S	--	--	--	--
AG	<.00030	--	--	--
AL	.63	--	--	--
ALKCO3	--	--	--	--
ALKHCO3	--	510.	--	550.
ALKTOT	--	--	--	550.
AS	.0060	--	--	--
B	<.0010	--	--	--
BA	.32	--	--	--
BE	<.00010	--	--	--
BR	--	--	--	--
CA	220.	56.	--	140.
CD	.0024	--	--	--
CL	110.	87.	--	40.
CO	<.10	--	--	--
COND	160.	190.	--	160.
CR	<.0050	--	--	--
CU	.0017	--	--	--
F	.30	--	--	--
FE	110.	56.	--	4.5
HG	.00016	--	--	--
I	--	--	--	--
K	6.3	8.0	--	--
MG	63.	68.	--	--
MN	2.3	2.0	--	2.1
MO	<.20	--	--	--
NA	27.	34.	--	43.
NI	<.0030	--	--	--
NO3	.20	--	--	--
PB	<.0020	--	--	--
PH	7.9	6.7	--	6.5
PO4	<.10	<.10	--	<.10
SE	<.0010	--	--	--
SI	[illegible]	--	--	--
SO4	19.	19.	--	400.
SR	[illegible]	--	--	--
TH	<.0[illegible]0	--	--	--
TI	.012	--	--	--
V	.0[illegible]0	--	--	--
ZN	[illegible]	--	--	--
ZR	<.[illegible]10	--	--	--

SAMPLING DATE

FUEL STORAGE AREA GROUNDWATER MONITORING PROGRAM 1980-81 THUNDER BAY TGS

LOCATION : 10A

TEST	800704	800919	810511	810826
	SAMPLING DATE			
ACIDITY	--	--	--	--
AG	<.00030	--	--	--
AL	<.10	--	--	--
ALKCO3	--	--	--	--
ALKHCO3	--	12.	6.0	40.
ALKTOT	--	--	6.0	40.
AS	.038	--	--	--
B	20.	--	2.4	--
BA	.19	--	--	--
BE	<.00010	--	--	--
BR	--	--	--	--
CA	300.	95.	--	360.
CD	.0022	--	--	--
CL	49.	34.	35.	31.
CO	<.10	--	--	--
COND	170.	360.	320.	280.
CR	.012	--	--	--
CU	.0023	--	--	--
F	.30	--	<.10	--
FE	.16	85.	--	7.8
HG	.00013	--	--	--
I	--	--	--	--
K	11.	5.0	--	--
MG	55.	1500.	--	--
MN	1.5	45.	--	71.
MO	<.20	--	--	--
NA	45.	190.	--	190.
NI	.0040	--	--	--
NO3	.30	--	<.10	--
PB	<.020	--	--	--
PH	7.8	6.4	5.1	6.2
PO4	<.10	<.10	.16	<.10
SB	<.0010	--	--	--
SI	7.8	--	16.	--
SO4	400.	1900.	2500.	1700.
SR	2.9	--	--	--
TH	<.040	--	--	--
TI	<.010	--	--	--
V	<.0030	--	--	--
ZN	.020	--	--	--
ZR	<.010	--	--	--

FUEL STORAGE AREA GROUNDWATER MONITORING PROGRAM 1980-81 THUNDER BAY TGS

LOCATION : 18B

TEST	800704	800919	810511	810826
			SAMPLING DATE	
ACIDITY	--	64.	--	--
AG	<.00030	--	.00020	--
AL	<.10	--	.58	--
ALKCO3	--	--	--	--
ALKHCO3	--	--	--	38.
ALKTOT	--	--	--	38.
AS	.0080	--	.0020	--
B	1.7	--	2.2	--
BA	.15	--	--	--
BE	<.00010	--	<.00010	--
BR	--	--	1.0	--
CA	140.	130.	500.	340.
CD	.00060	--	<.00010	--
CL	60.	48.	41.	57.
CO	<.10	--	.10	--
COND	81.	450.	360.	300.
CR	<.0050	--	.10	--
CU	.034	--	<.0010	--
F	.20	--	<.10	--
FE	51.	160.	370.	8.1
HG	.00037	--	<.00040	--
I	--	--	.30	--
K	2.1	7.0	4.0	--
MG	34.	190.	200.	--
MN	3.7	100.	14.	89.
MO	<.20	--	<.25	--
NA	12.	180.	130.	190.
NI	.0035	--	<.0050	--
NO3	.70	--	<.10	--
PB	<.020	--	<.0020	--
PH	6.7	6.6	4.8	6.3
PO4	<.10	<.10	.32	<.10
SE	<.0010	--	<.0010	--
SI	26.	--	20.	--
SO4	35.	790.	3000.	2000.
SR	.38	--	1.0	--
TH	<.040	--	--	--
TI	<.010	--	<1.0	--
V	.0050	--	.0070	--
ZN	.34	--	.070	--
ZR	<.010	--	--	--

FUEL STORAGE AREA GROUNDWATER MONITORING PROGRAM 1980-81 THUNDER BAY TGS

LOCATION : 19A

TEST	800704	800919	810511	810826
			SAMPLING DATE	
ACID4.5	--	--	--	--
AG	--	--	.00030	--
AL	--	--	5.0	--
ALKCO3	--	--	--	--
ALPHCO3	--	68.	--	4.0
ALKTOT	--	--	--	4.0
AS	--	--	<.0010	--
B	1.8	--	2.1	--
BA	--	--	--	--
BE	--	--	.0053	--
BR	--	--	1.5	--
CA	--	35.	370.	440.
CD	--	--	.0033	--
CL	37.	30.	41.	35.
CO	--	--	.10	--
COND	360.	460.	350.	390.
CR	--	--	.10	--
CU	--	--	.0080	--
F	4.5	--	3.5	--
FE	--	19.	180.	8.1
HG	--	--	<.00040	--
I	--	--	.20	--
K	--	10.	9.0	--
MG	--	96.	170.	--
MN	--	57.	79.	89.
MO	--	--	<.25	--
NA	--	310.	300.	720.
NI	--	--	.65	--
NO3	1.2	--	<.10	--
PB	--	--	<.0020	--
PH	5.6	6.5	4.8	5.1
PO4	--	<.10	.15	<.10
SE	--	--	<.0010	--
SI	--	--	23.	--
SO4	2400.	300.	<.10	2100.
SR	--	--	.96	--
TH	--	--	--	--
TI	--	--	<1.0	--
V	--	--	.010	--
ZN	--	--	.41	--
ZR	--	--	--	--

FUEL STORAGE AREA GROUNDWATER MONITORING PROGRAM 1980-81 THUNDER BAY TGS

LOCATION : 19B

TEST	800704	800919	810511	810826
			SAMPLING DATE	
ACID4.5	--	42.	--	--
AG	<.00030	--	.00020	--
AL	1.6	--	<.10	--
ALKCO3	--	--	--	--
ALKHCO3	--	--	--	30.
ALKTOT	--	--	--	30.
AS	.0020	--	.0050	--
B	1.9	--	.60	--
BA	.060	--	--	--
BE	<.00010	--	<.00010	--
BR	--	--	3.0	--
CA	440.	130.	320.	220.
CD	.013	--	<.00010	--
CL	50.	50.	53.	59.
CO	.10	--	.10	--
COND	450.	460.	410.	350.
CR	<.0050	--	.10	--
CU	.0046	--	<.0010	--
F	4.5	--	3.7	--
FE	290.	330.	190.	8.1
HG	.00011	--	<.00040	--
I	--	--	<.050	--
K	6.7	6.0	3.0	--
MG	230.	1200.	180.	--
MN	120.	40.	51.	48.
MO	<.20	--	<.25	--
NA	190.	350.	340.	390.
NI	.051	--	<.0050	--
NO3	<.10	--	<.10	--
PB	.0068	--	<.0020	--
PH	5.3	6.4	4.6	6.1
PO4	<.10	<.10	.74	<.10
SE	<.0010	--	<.0010	--
SI	23.	--	22.	--
SO4	3300.	140.	3100.	2600.
SR	.57	--	.42	--
TH	<.040	--	--	--
TI	<.010	--	<1.0	--
V	.017	--	.020	--
ZN	.23	--	.12	--
ZR	<.010	--	--	--

FUEL STORAGE AREA GROUNDWATER MONITORING PROGRAM 1980-81 THUNDER BAY TGS

LOCATION : 20A

TEST	800704	800919	810511	810826
		SAMPLING DATE		
ACID4.5	--	--	--	--
AG	.00040	--	.00020	--
AL	.77	--	<.10	--
ALKCO3	--	--	--	--
ALKHCO3	--	280.	270.	--
ALKTOT	--	--	270.	--
AS	<.0010	--	<.0010	--
B	2.0	--	17.	--
BA	.030	--	--	--
BE	<.00010	--	<.00010	--
BR	--	--	.80	--
CA	450.	66.	270.	--
CD	.0011	--	<.00010	--
CL	50.	48.	45.	--
CO	.26	--	.10	--
COND	380.	180.	150.	--
CR	<.0050	--	<.10	--
CU	.014	--	<.0010	--
F	5.3	--	1.4	--
FE	110.	33.	.14	--
HG	.00015	--	.00060	--
I	--	--	<.050	--
K	8.5	12.	11.	--
MG	150.	35.	28.	--
MH	59.	1.0	.80	--
MO	.43	--	<.25	--
NA	260.	74.	100.	--
NI	.21	--	<.0050	--
NO3	<.10	--	<.10	--
PB	.0020	--	<.0020	--
PH	6.3	7.5	7.8	--
PO4	<.10	<.10	.11	--
SE	<.0010	--	<.0010	--
SI	19.	--	3.9	--
SO4	2600.	160.	740.	--
SR	.47	--	5.5	--
TH	.62	--	--	--
TI	<.010	--	<1.0	--
V	.010	--	.0020	--
ZN	.23	--	<.050	--
ZR	<.010	--	--	--

FUEL STORAGE AREA GROUNDWATER MONITORING PROGRAM 1980-81 THUNDER BAY TGS

LOCATION : 20B

TEST	800704	800919	810511	810826
			SAMPLING DATE	
ACT 4.5	--	--	--	--
AG	<.00030	--	<.00020	--
AL	.15	--	.30	--
ALKCO3	--	--	--	--
ALKHCO3	--	330.	400.	--
ALKTOT	--	--	400.	--
AS	.0020	--	.024	--
B	1.1	--	.80	--
BA	.030	--	--	--
BE	<.00010	--	<.00010	--
BR	--	--	.60	--
CA	280.	97.	120.	--
CD	<.00010	--	<.00010	--
CL	44.	46.	45.	--
CO	.10	--	.10	--
COND	400.	190.	79.	--
CR	<.0050	--	<.10	--
CU	.0054	--	<.0010	--
F	3.5	--	1.0	--
FE	590.	3.0	67.	--
HG	.00037	--	<.00040	--
I	--	--	<.050	--
K	5.0	9.0	1.5	--
MG	160.	57.	32.	--
MN	39.	5.0	6.0	--
MO	.20	--	<.25	--
NA	270.	130.	13.	--
NI	.0070	--	<.0050	--
NO3	<.10	--	<.10	--
PB	<.0020	--	<.0020	--
PH	4.7	6.8	6.5	--
PO4	<.10	<.10	.046	--
SE	<.0010	--	<.0010	--
SI	27.	--	15.	--
SO4	2800.	16.	3.1	--
SR	.23	--	.52	--
TH	<.040	--	--	--
TI	.011	--	<1.0	--
V	.009	--	.0010	--
ZN	.22	--	.86	--
ZR	<.010	--	--	--

FUEL STORAGE AREA GROUNDWATER MONITORING PROGRAM 1980-81 THUNDER BAY TGS

LOCATION : POND-E

TEST	800704	800919	810511	810826
			SAMPLING DATE	
ACID4.5	--	--	--	--
AG	--	--	<.00020	--
AL	--	--	<.20	--
ALFCO3	--	--	--	--
ALFHCO3	--	--	100.	--
ALKTOT	--	--	100.	--
AS	--	--	.0070	--
B	--	--	2.3	--
BA	--	--	--	--
BE	--	--	<.00010	--
BR	--	--	<.20	--
CA	--	--	90.	--
CD	--	--	<.00010	--
CL	--	--	65.	--
CO	--	--	.10	--
COND	--	--	78.	--
CR	--	--	<.10	--
CU	--	--	<.0010	--
F	--	--	1.3	--
FE	--	--	<.050	--
HG	--	--	<.00040	--
I	--	--	<.050	--
K	--	--	2.8	--
MG	--	--	24.	--
MN	--	--	.70	--
MO	--	--	<.25	--
NA	--	--	59.	--
NI	--	--	<.0050	--
NO3	--	--	<.10	--
PB	--	--	<.0020	--
PH	--	--	8.2	--
PO4	--	--	.37	--
SE	--	--	.0020	--
SI	--	--	5.3	--
SO4	--	--	260.	--
SR	--	--	.050	--
TH	--	--	--	--
TI	--	--	<1.0	--
V	--	--	<.0050	--
ZN	--	--	.020	--
ZR	--	--	--	--

FUEL STORAGE AREA GROUNDWATER MONITORING PROGRAM 1980-81 THUNDER BAY TGS

LOCATION : POND-W

TEST	800704	800919	810511	810826
			SAMPLING DATE	
ACIDW.S	--	--	--	--
AG	--	--	--	--
AL	--	--	<.00020	--
ALKCO3	--	--	<.20	--
ALKHCO3	--	--	--	--
ALKTOT	--	--	100.	--
AS	--	--	100.	--
B	--	--	.0070	--
BA	--	--	2.3	--
BE	--	--	--	--
BR	--	--	<.00010	--
CA	--	--	<.20	--
CD	--	--	84.	--
CL	--	--	<.00010	--
CO	--	--	70.	--
COND	--	--	.10	--
CR	--	--	88.	--
CU	--	--	<.10	--
F	--	--	<.0010	--
FE	--	--	.50	--
HG	--	--	<.050	--
I	--	--	<.00040	--
K	--	--	<.050	--
MG	--	--	2.8	--
MN	--	--	24.	--
MO	--	--	1.6	--
NA	--	--	<.05	--
NI	--	--	60.	--
NO3	--	--	<.0050	--
P	--	--	<.10	--
PB	--	--	<.0020	--
PH+	--	--	7.5	--
SE	--	--	.012	--
SI	--	--	.0030	--
SO4	--	--	5.0	--
SR	--	--	270.	--
TH	--	--	.03	--
TI	--	--	--	--
V	--	--	<1.0	--
ZN	--	--	<.0050	--
ZR	--	--	.030	--

APPENDIX B

FUEL STORAGE AREA - GROUNDWATER MONITORING PROGRAM

THUNDER BAY TGS EXTENSION

GROUNDWATER MAJOR ION CHEMISTRY

AND

PIPER DIAGRAMS

1979-1981

(Where discrepancies in analytic results produced very wide differences in ion balances these data are not shown.)

MAJOR ION CHEMISTRY

TYPE - WATER
LOCATION 01A

STUDY & DATE	CATIONS CA MG/L	CA EPM	CA %EPM	MG MG/L	MG EPM	MG %EPM	NA MG/L	NA EPM	NA %EPM	K MG/L	K EPM	K %EPM	CATION TOTAL	ANION TOTAL	
TBTGS FUEL															
JUNE 14 1979	82	4.09	54	34	2.76	36	17	.74	10	1	.03	0	7.62	6.46*	P
SEPT 27 1979	85	4.22	52	31	2.53	31	28	1.22	15	3	.08	1	8.05	8.30	P
SEPT 19 1980	37	1.85	28	31	2.55	39	42	1.83	28	10	.26	4	6.48	11.98*	P
JULY 04 1980	114	5.69	50	56	4.60	41	19	.83	7	8	.19	2			
MAY 11 1981	79	3.94	46	33	2.72	32	41	1.78	21	2	.05	1	8.49	8.56	P

STUDY & DATE	ANIONS CL MG/L	CL EPM	CL %EPM	SO4 MG/L	SO4 EPM	SO4 %EPM	HCO3 MG/L	HCO3 EPM	HCO3 %EPM	CO3 MG/L	CO3 EPM	CO3 %EPM	ANION TOTAL	CATION TOTAL	
TBTGS FUEL-															
JUNE 14 1979	67	1.88	29	5	.10	1	273	4.48	69	0	.00	0	6.46	7.62*	P
SEPT 27 1979	87	2.46	30	39	.81	10	307	5.04	61	0	.00	0	8.30	8.05	P
SEPT 19 1980	82	2.31	19	10	.21	2	577	9.46	79	0	.00	0	11.98	6.48*	P
JULY 04 1980	90	2.54	61	77	1.60	39	ND			ND					
MAY 11 1981	98	2.76	32	0	.00	0	354	5.80	68	0	.00	0	8.56	8.49	P

* INDICATES ANION AND CATION TOTALS DON'T LIE WITHIN 10% OF EACH OTHER.

ND = Not Determined
P = Plotted on Piper Diagram
E = Error

MAJOR ION CHEMISTRY

TYPE - WATER
LOCATION 04A

STUDY & DATE	CATIONS CA MG/L	CA EPM	CA %EPM	MG MG/L	MG EPM	MG %EPM	NA MG/L	NA EPM	NA %EPM	K MG/L	K EPM	K %EPM	CATION TOTAL	ANION TOTAL	
TBTGS FUEL															
JUNE 14 1979	150	7.48	53	56	4.62	33	45	1.96	14	1	.03	0	14.08	14.22	P
SEPT 27 1979	106	5.29	51	37	3.00	29	48	2.09	20	2	.05	0	10.43	10.99	P
SEPT 19 1980	38	1.90	22	53	4.36	50	54	2.35	27	8	.20	2	8.81	8.68	P
JULY 04 1980	129	6.43	55	42	3.48	30	41	1.77	15	2	.05	0			P
AUG 26 1981	75	3.74	59	ND			61	2.65	41	ND					
MAY 11 1981	134	6.68	53	58	4.77	38	23	1.00	8	4	.09	1	12.55	12.77	P

STUDY & DATE	ANIONS CL MG/L	CL EPM	CL %EPM	SO4 MG/L	SO4 EPM	SO4 %EPM	HCO3 MG/L	HCO3 EPM	HCO3 %EPM	CO3 MG/L	CO3 EPM	CO3 %EPM	ANION TOTAL	CATION TOTAL	
TBTGS FUEL															
JUNE 14 1979	55	1.55	11	267	5.56	39	434	7.12	50	0	.00	0	14.22	14.08	P
SEPT 27 1979	76	2.13	19	72	1.50	14	449	7.36	67	0	.00	0	10.99	10.43	P
SEPT 19 1980	30	.85	10	64	1.33	15	396	6.50	75	0	.00	0	8.68	8.81	P
JULY 04 1980	73	2.04	97	4	.07	3	ND			ND					P
AUG 26 1981	75	2.11	20	59	1.23	12	427	7.00	68	0	.00	0			
MAY 11 1981	31	.87	7	149	3.10	24	537	8.80	69	0	.00	0	12.77	12.55	P

* INDICATES ANION AND CATION TOTALS DON'T LIE WITHIN 10% OF EACH OTHER.

ND = Not determined
P = Plotted on Piper Diagram
E = Error

MAJOR ION CHEMISTRY

TYPE - WATER
LOCATION 05C

STUDY & DATE	CATIONS CA MG/L	CA EPM	CA %EPM	MG MG/L	MG EPM	MG %EPM	NA MG/L	NA EPM	NA %EPM	K MG/L	K EPM	K %EPM	CATION TOTAL	ANION TOTAL	
TBTGS FUEL															
JUNE 14 1979	182	9.08	52	72	5.93	34	53	2.30	13	1	.03	0	17.34	17.73	P
SEPT 27 1979	194	9.68	61	47	3.89	25	49	2.13	13	4	.10	1	15.80	16.15	P
SEPT 19 1980	155	7.73	36	76	6.26	29	170	7.39	34	8	.20	1	21.58	6.71*	P
JULY 04 1980	252	12.57	62	70	5.74	28	44	1.90	9	4	.11	1			P
AUG 26 1981	167	8.33	76	ND			59	2.57	24	ND					
MAY 11 1981	258	12.87	43	108	8.89	30	180	7.83	26	3	.08	0			P

STUDY & DATE	ANIONS CL MG/L	CL EPM	CL %EPM	SO4 MG/L	SO4 EPM	SO4 %EPM	HCO3 MG/L	HCO3 EPM	HCO3 %EPM	CO3 MG/L	CO3 EPM	CO3 %EPM	ANION TOTAL	CATION TOTAL	
TBTGS FUEL															
JUNE 14 1979	246	6.93	39	2	.04	0	656	10.76	61	0	.00	0	17.73	17.34	P
SEPT 27 1979	289	8.14	50	20	.41	3	464	7.60	47	0	.00	0	16.15	15.80	P
SEPT 19 1980	135	3.80	57	9	.19	3	166	2.72	41	0	.00	0	6.71	21.58*	P
JULY 04 1980	205	5.77	97	8	.17	3	ND			0	.00	0			
AUG 26 1981	136	3.83	23	4	.07	0	758	12.42	76	0	.00	0			P
MAY 11 1981	E			0	00	0	317	5.20	15	0	.00	0			

* INDICATES ANION AND CATION TOTALS DON'T LIE WITHIN 10% OF EACH OTHER.

ND = Not determined
P = Plotted on Piper Diagram
E = Error

MAJOR ION CHEMISTRY

TYPE - WATER
LOCATION 06B

STUDY & DATE	CATIONS CA MG/L	CA EPM	CA %EPM	MG MG/L	MG EPM	MG %EPM	NA MG/L	NA EPM	NA %EPM	K MG/L	K EPM	K %EPM	CATION TOTAL	ANION TOTAL	
TBTGS FUEL															
JUNE 14 1979	163	8.13	54	63	5.20	35	39	1.70	11	1	.03	0	15.05	15.32	P
SEPT 27 1979	159	7.93	58	48	3.97	29	37	1.61	12	4	.10	1	13.61	6.28*	P
SEPT 19 1980	104	5.19	45	54	4.44	39	38	1.65	14	6	.15	1	11.44	18.24*	P
JULY 04 1980	220	10.97	63	58	4.73	27	37	1.62	9	4	.11	1			P
AUG 26 1981	138	6.88	78	ND			45	1.96	22	ND					
MAY 11 1981	175	8.73	58	56	4.61	30	40	1.74	11	3	.07	0	15.15	16.35	P

STUDY & DATE	ANIONS CL MG/L	CL EPM	CL %EPM	SO4 MG/L	SO4 EPM	SO4 %EPM	HCO3 MG/L	HCO3 EPM	HCO3 %EPM	CO3 MG/L	CO3 EPM	CO3 %EPM	ANION TOTAL	CATION TOTAL	
TBTGS FUEL															
JUNE 14 1979	253	7.13	47	6	.12	1	493	8.08	53	0	.00		15.32	15.05	P
SEPT 27 1979	ND			6	.12	2	376	6.16	93	0	.00		6.28	13.61*	
SEPT 19 1980	320	9.01	49	9	.19	1	551	9.04	50	0	.00		18.24	11.44*	P
JUNE 24 1980										0	.00				
JULY 04 1980	232	6.54	100	1	.02	0	ND			0	.00				P
AUG 26 1981	160	4.51	35	3	.06	0	506	8.30	65	0	.00				
MAY 11 1981	254	7.15	44	0	.00	0	561	9.20	56	0	.00		16.35	15.15	P

* INDICATES ANION AND CATION TOTALS DON'T LIE WITHIN 10% OF EACH OTHER.

ND = Not determined
P = Plotted on Piper Diagram
E = Error

MAJOR ION CHEMISTRY

TYPE - WATER
LOCATION 06C

STUDY & DATE	CATIONS CA MG/L	CA EPM	CA %EPM	MG MG/L	MG EPM	MG %EPM	NA MG/L	NA EPM	NA %EPM	K MG/L	K EPM	K %EPM	CATION TOTAL	ANION TOTAL	
TBTGS FUEL															
JUNE 14 1979	218	10.87	55	94	7.76	39	29	1.26	6	1	.03	0	19.92	19.25	P
SEPT 27 1979	213	10.62	58	76	6.21	34	30	1.30	7	3	.08	0	18.22	20.87*	P
SEPT 19 1980	88	4.39	40	48	3.95	36	54	2.35	22	6	.15	1	10.84	11.65	P
JULY 04 1980	162	8.08	51	64	5.26	33	55	2.39	15	3	.08	1			P
AUG 26 1981	97	4.84	67	ND			54	2.35	33	ND					
MAY 11 1981	130	6.48	50	51	4.20	32	52	2.26	17	2	.06	0	13.00	14.33	P

STUDY & DATE	ANIONS CL MG/L	CL EPM	CL %EPM	SO4 MG/L	SO4 EPM	SO4 %EPM	HCO3 MG/L	HCO3 EPM	HCO3 %EPM	CO3 MG/L	CO3 EPM	CO3 %EPM	ANION TOTAL	CATION TOTAL	
TBTGS FUEL															
JUNE 14 1979	117	3.30	17	2	.04	0	971	15.92	83	0	.00	0	19.25	19.92	P
SEPT 27 1979	214	6.03	29	10	.20	1	893	14.64	70	0	.00	0	20.87	18.22*	P
SEPT 19 1980	133	3.75	32	9	.19	2	471	7.72	66	0	.00	0	11.65	10.84	P
JULY 04 1980	32	6.54	100	1	.02	0	ND			0	.00	0			P
AUG 26 1981	154	4.34	39	3	.05	0	414	6.78	61	1	.02	0			
MAY 11 1981	246	6.93	48				451	7.40	52	0	.00	0	14 33	13.00	P

* INDICATES ANION AND CATION TOTALS DON'T LIE WITHIN 10% OF EACH OTHER.

ND = Not determined
P = Plotted on Piper Diagram
E = Error

MAJOR ION CHEMISTRY

TYPE - WATER
LOCATION 07B

STUDY & DATE	CATIONS CA MG/L	CA EPM	CA %EPM	MG MG/L	MG EPM	MG %EPM	NA MG/L	NA EPM	NA %EPM	K MG/L	K EPM	K %EPM	CATION TOTAL	ANION TOTAL	
TBTGS FUEL															
JUNE 14 1979	106	5.29	55	42	3.48	37	17	.74	8	1	.03	0	9.53	9.11	P
SEPT 27 1979	109	5.44	59	36	2.96	32	18	.78	8	1	.03	0	9.21	9.93	P
SEPT 19 1980	23	1.15	25	29	2.39	52	20	.87	19	9	.23	5	4.63	5.88*	P
JULY 04 1980	136	6.78	59	47	3.88	34	16	.71	6	3	.08	1			P
AUG 26 1981	72	3.59	76	ND			26	1.13	24	ND					
MAY 11 1981	ND			ND			ND			ND					

STUDY & DATE	ANIONS CL MG/L	CL EPM	CL %EPM	SO4 MG/L	SO4 EPM	SO4 %EPM	HCO3 MG/L	HCO3 EPM	HCO3 %EPM	CO3 MG/L	CO3 EPM	CO3 %EPM	ANION TOTAL	CATION TOTAL	
TBTGS FUEL															
JUNE 14 1979	55	1.54	17	43	.90	10	407	6.68	73	0	.00	0	9.11	9.53	P
SEPT 27 1979	71	1.99	20	47	.99	10	425	6.96	70	0	.00	0	9.93	9.21	P
SEPT 19 1980	46	1.30	22	11	.23	4	266	4.36	74	0	.00	0	5.88	4.63*	P
JULY 04 1980	75	2.11	79	27	.56	21	ND			0	.00	0			
AUG 26 1981	88	2.48	26	ND			438	7.18	74	0	.00	0			
MAY 11 1981	85	2.39	23	5	.11	1	476	7.80	76	0	.00	0			P

* INDICATES ANION AND CATION TOTALS DON'T LIE WITHIN 10% OF EACH OTHER.

ND = Not determined
P = Plotted on Piper Diagram
E = Error

MAJOR ION CHEMISTRY

TYPE - WATER
LOCATION 083

CATIONS

STUDY & DATE	CA MG/L	CA EPM	CA %EPM	MG MG/L	MG EPM	MG %EPM	NA MG/L	NA EPM	NA %EPM	K MG/L	K EPM	K %EPM	CATION TOTAL	ANION TOTAL	
TBTGS FUEL															
JUNE 14 1979	107	5.34	67	21	1.70	21	22	.96	12	1	.03	0	8.02	7.83	P
SEPT 27 1979	86	4.29	65	15	1.21	18	23	1.00	15	3	.08	1	6.58	7.41*	P
JULY 04 1980	168	8.38	74	22	1.77	16	24	1.02	9	8	.21	2			P
AUG 26 1981	71	3.54	50	ND			80	3.48	50	ND					
MAY 11 1981	117	5.84	61	17	1.40	15	50	2.17	23	4	.11	1	9.52	10.56	P

ANIONS

STUDY & DATE	CL MG/L	CL EPM	CL %EPM	SO4 MG/L	SO4 EPM	SO4 %EPM	HCO3 MG/L	HCO3 EPM	HCO3 %EPM	CO3 MG/L	CO3 EPM	CO3 %EPM	ANION TOTAL	CATION TOTAL	
TBTGS FUEL															
JUNE 14 1979	16	.45	6	128	2.66	34	288	4.72	60	0	.00	0	7.83	8.02	P
SEPT 27 1979	27	.76	10	162	3.37	45	200	3.28	44	0	.00	0	7.41	6.53*	P
JULY 04 1980	35	.99	12	340	7.08	88	ND			0	.00	0			
AUG 26 1981	44	1.24	16	250	5.20	68	77	1.26	16	0	.00	0			P
MAY 11 1981	39	1.10	10	420	8.74	83	44	.72	7	0	.00	0	10.56	9.52	P

* INDICATES ANION AND CATION TOTALS DON'T LIE WITHIN 10% OF EACH OTHER.

ND = Not determined
P = Plotted on Piper Diagram
E = Error

MAJOR ION CHEMISTRY

TYPE - WATER
LOCATION 10B

CATIONS

STUDY & DATE	CA MG/L	CA EPM	CA %EPM	MG MG/L	MG EPM	MG %EPM	NA MG/L	NA EPM	NA %EPM	K MG/L	K EPM	K %EPM	CATION TOTAL	ANION TOTAL	
TBTGS FUEL															
JUNE 14 1979	96	4.78	60	28	2.33	29	19	.83	10	1	.03	0	7.96	9.66*	P
SEPT 27 1979	86	4.29	61	24	1.95	28	17	.74	11	1	.03	0	7.00	7.27	P
SEPT 19 1980	30	1.50	32	24	1.98	43	23	1.00	22	6	.15	3	4.63	5.96*	P
JULY 04 1980	116	5.79	66	26	2.16	24	19	.81	9	3	.07	1			P

ANIONS

STUDY & DATE	CL MG/L	CL EPM	CL %EPM	SO4 MG/L	SO4 EPM	SO4 %EPM	HCO3 MG/L	HCO3 EPM	HCO3 %EPM	CO3 MG/L	CO3 EPM	CO3 %EPM	ANION TOTAL	CATION TOTAL	
TBTGS FUEL															
JUNE 14 1979	20	.57	6	239	4.97	51	251	4.12	43	0	.00	0	9.66	7.96*	P
SEPT 27 1979	35	1.00	14	59	1.23	17	307	5.04	69	0	.00	0	7.27	7.00	P
SEPT 19 1980	24	.68	11	77	1.60	27	224	3.68	62	0	.00	0	5.96	4.63*	P
JULY 04 1980	43	1.20	33	115	2.39	67	ND			0	.00	0			

* INDICATES ANION AND CATION TOTALS DON'T LIE WITHIN 10% OF EACH OTHER.

ND = Not determined
P = Plotted on Piper Diagram
E = Error

MAJOR ION CHEMISTRY

TYPE - WATER
LOCATION 10C

CATIONS

STUDY & DATE	CA MG/L	CA EPM	CA %EPM	MG MG/L	MG EPM	MG %EPM	NA MG/L	NA EPM	NA %EPM	K MG/L	K EPM	K %EPM	CATION TOTAL	ANION TOTAL	
TBTGS FUEL															
JUNE 14 1979	164	8.18	69	32	2.65	22	23	1.00	8	4	.10	1	11.93	14.29*	P
SEPT 27 1979	141	7.03	69	26	2.15	21	21	.91	9	3	.08	1	10.17	11.04	P
SEPT 19 1980	78	3.89	35	61	5.02	46	45	1.96	18	6	.15	1	11.02	13.59*	P
JULY 04 1980	190	9.48	71	31	2.58	19	24	1.06	8	6	.14	1			P

ANIONS

STUDY & DATE	CL MG/L	CL EPM	CL %EPM	SO4 MG/L	SO4 EPM	SO4 %EPM	HCO3 MG/L	HCO3 EPM	HCO3 %EPM	CO3 MG/L	CO3 EPM	CO3 %EPM	ANION TOTAL	CATION TOTAL	
TBTGS FUEL															
JUNE 14 1979	27	.75	5	430	8.95	63	281	4.60	32	0	.00	0	14.29	11.93*	P
SEPT 27 1979	28	.79	7	145	3.02	27	442	7.24	66	0	.00	0	11.04	10.17	P
SEPT 19 1980	94	2.65	19	9	.19	1	656	10.76	79	0	.00	0	13.59	11.02*	P
JULY 04 1980	158	4.45	88	28	.58	12	ND			0	.00	0			

* INDICATES ANION AND CATION TOTALS DON'T LIE WITHIN 10% OF EACH OTHER.

ND = Not determined
P = Plotted on Piper Diagram
E = Error

MAJOR ION CHEMISTRY

TYPE - WATER
LOCATION 12C

STUDY & DATE	CATIONS CA MG/L	CA EPM	CA %EPM	MG MG/L	MG EPM	MG %EPM	NA MG/L	NA EPM	NA %EPM	K MG/L	K EPM	K %EPM	CATION TOTAL	ANION TOTAL	
TBTGS FUEL															
JUNE 14 1979	526	26.23	62	167	13.74	32	52	2.26	5	6	.15	0	42.39	56.15*	P
SEPT 27 1979	579	28.88	57	229	18.85	37	63	2.74	5	20	.51	1			P
SEPT 19 1980	60	2.99	28	75	6.17	57	29	1.26	12	14	.36	3	10.78	16.96*	P
JULY 04 1980	179	8.93	65	46	3.74	27	22	.96	7	6	.16	1			P
AUG 26 1981	24	1.20	62	ND			17	.74	38	ND					
MAY 11 1981	77	3.84	58	22	1.81	27	20	.87	13	3	.08	1			P

STUDY & DATE	ANIONS CL MG/L	CL EPM	CL %EPM	SO4 MG/L	SO4 EPM	SO4 %EPM	HCO3 MG/L	HCO3 EPM	HCO3 %EPM	CO3 MG/L	CO3 EPM	CO3 %EPM	ANION TOTAL	CATION TOTAL	
TBTGS FUEL															
JUNE 14 1979	50	1.40	2	2550	53.07	95	102	1.68	3	0	.00	0	56.15	42.39*	P
SEPT 27 1979	60	1.69	3	3080	64.10	97	ND			0	.00	0			
SEPT 19 1980	43	1.21	7	624	12.99	77	168	2.76	16	0	.00	0	16.96	10.78*	P
JULY 04 1980	28	.79	6	630	13.11	94	ND			0	.00	0			P
AUG 26 1981	16	.45	16	100	2.08	76	12	.20	7	0	.00	0			
MAY 11 1981	17	.48	25	ND			88	1.44	75	0	.00	0			

* INDICATES ANION AND CATION TOTALS DON'T LIE WITHIN 10% OF EACH OTHER.

ND = Not determined
P = Plotted on Piper Diagram
E = Error

MAJOR ION CHEMISTRY

TYPE - WATER
LOCATION 13B

CATIONS

STUDY & DATE	CA MG/L	CA EPM	CA %EPM	MG MG/L	MG EPM	MG %EPM	NA MG/L	NA EPM	NA %EPM	K MG/L	K EPM	K %EPM	CATION TOTAL	ANION TOTAL	
TBTGS FUEL															
JUNE 14 1979	485	24.19	43	248	20.41	37	245	10.65	19	21	.54	1	55.79	89.02*	P
SEPT 27 1979	493	24.59	45	244	20.08	37	205	8.91	16	25	.64	1			P
SEPT 19 1980	206	10.27	34	179	14.73	48	121	5.26	17	12	.31	1			P
JULY 04 1980	409	20.40	51	187	15.39	39	86	3.73	9	14	.36	1			P
AUG 26 1981	452	22.54	84	ND			100	4.35	16	ND					
MAY 11 1981	300	14.96	54	116	9.55	34	69	3.00	11	12	.31	1			P

ANIONS

STUDY & DATE	CL MG/L	CL EPM	CL %EPM	SO4 MG/L	SO4 EPM	SO4 %EPM	HCO3 MG/L	HCO3 EPM	HCO3 %EPM	CO3 MG/L	CO3 EPM	CO3 %EPM	ANION TOTAL	CATION TOTAL	
TBTGS FUEL															
JUNE 14 1979	54	1.53	2	4200	87.41	98	5	.08	0	0	.00	0	89.02	55.79*	P
SEPT 27 1979	81	2.28	3	3790	78.88	97	ND			0	.00	0			
SEPT 19 1980	17	.48	2	1430	29.76	98	ND			0	.00	0			
JULY 04 1980	37	1.04	2	2750	57.23	98	ND			0	.00	0			
AUG 26 1981	33	.93	2	2555	53.17	98	10	.16	0	0	.00	0			P
MAY 11 1981	26	.73	2	2300	47.87	98	ND			0	.00	0			

* INDICATES ANION AND CATION TOTALS DON'T LIE WITHIN 10% OF EACH OTHER.

ND = Not determined
P = Plotted on Piper Diagram
E = Error

MAJOR ION CHEMISTRY

TYPE - WATER
LOCATION 13C

STUDY & DATE	CATIONS CA MG/L	CA EPM	CA %EPM	MG MG/L	MG EPM	MG %EPM	NA MG/L	NA EPM	NA %EPM	K MG/L	K EPM	K %EPM	CATION TOTAL	ANION TOTAL	
TBTGS FUEL															
JUNE 14 1979	590	29.43	47	287	23.62	38	214	9.30	15	22	.56	1			P
SEPT 27 1979	512	25.54	43	295	24.28	41	190	8.26	14	33	.84	1			P
SEPT 19 1980	310	15.46	38	220	18.11	45	148	6.43	16	14	.36	1			P
JULY 04 1980	345	17.21	53	148	12.18	38	56	2.44	8	16	.42	1			P
AUG 26 1981	354	17.66	79	ND			107	4.65	21	ND					
MAY 11 1981	370	18.45	53	150	12.35	36	80	3.48	10	9	.23	1			P

STUDY & DATE	ANIONS CL MG/L	CL EPM	CL %EPM	SO4 MG/L	SO4 EPM	SO4 %EPM	HCO3 MG/L	HCO3 EPM	HCO3 %EPM	CO3 MG/L	CO3 EPM	CO3 %EPM	ANION TOTAL	CATION TOTAL	
TBTGS FUEL															
JUNE 14 1979	63	1.79	2	3940	82.00	98	ND			0	.00	0			
SEPT 27 1979	93	2.61	3	4440	92.40	97	ND			0	.00	0			
SEPT 19 1980	19	.54	2	1430	29.76	98	ND			0	.00	0			
JULY 04 1980	40	1.13	2	3000	62.43	98	ND			0	.00	0			P
AUG 26 1981	30	.85	2	2250	46.83	98	17	.28	1	0	.00	0			
MAY 11 1981	33	.93	2	2660	55.36	98	ND			0	.00	0			

* INDICATES ANION AND CATION TOTALS DON'T LIE WITHIN 10% OF EACH OTHER.

ND = Not Determined
P = Plotted on Piper Diagram
E = Error

MAJOR ION CHEMISTRY

TYPE - WATER
LOCATION 14A

STUDY & DATE	CATIONS CA MG/L	CA EPM	CA %EPM	MG MG/L	MG EPM	MG %EPM	NA MG/L	NA EPM	NA %EPM	K MG/L	K EPM	K %EPM	CATION TOTAL	ANION TOTAL	
TBTGS FUEL															
JUNE 14 1979	260	12.97	34	197	16.21	43	199	8.65	23	10	.26	1	38.09	69.80*	P
SEPT 27 1979	245	12.22	35	185	15.23	43	173	7.52	21	10	.26	1			P
SEPT 19 1980	150	7.48	27	137	11.28	40	206	8.96	32	8	.20	1			P
JULY 04 1980	281	14.01	38	176	14.49	39	193	8.39	23	6	.14	0			P
AUG 26 1981	299	14.91	61	ND			217	9.43	39	ND					
MAY 11 1981	388	19.35	41	230	18.93	40	200	8.70	18	3	.09	0			P

STUDY & DATE	ANIONS CL MG/L	CL EPM	CL %EPM	SO4 MG/L	SO4 EPM	SO4 %EPM	HCO3 MG/L	HCO3 EPM	HCO3 %EPM	CO3 MG/L	CO3 EPM	CO3 %EPM	ANION TOTAL	CATION TOTAL	
TBTGS FUEL															
JUNE 14 1979	58	1.63	2	3260	67.85	97	20	.32	0	0	.00	0	69.80	38.09*	P
SEPT 27 1979	75	2.11	3	3110	64.72	97	ND			0	.00	0			
SEPT 19 1980	41	1.15	4	1314	27.35	96	ND			0	.00	0			
JULY 04 1980	70	1.97	3	2720	56.61	97	ND			0	.00	0			P
AUG 26 1981	66	1.86	4	2170	45.16	95	24	.40	1	0	.00	0			
MAY 11 1981	76	2.14	3	3360	69.93	97	ND			0	.00	0			

* INDICATES ANION AND CATION TOTALS DON'T LIE WITHIN 10% OF EACH OTHER.

ND = Not determined
P = Plotted on Piper Diagram
E = Error

MAJOR ION CHEMISTRY

TYPE - WATER
LOCATION 143

CATIONS

STUDY & DATE	CA MG/L	CA EPM	CA %EPM	MG MG/L	MG EPM	MG %EPM	NA MG/L	NA EPM	NA %EPM	K MG/L	K EPM	K %EPM	CATION TOTAL	ANION TOTAL	
TBIGS FUEL															
JUNE 14 1979	305	15.21	30	166	13.66	27	479	20.83	42	7	.18	0	49.88	80.69*	P
SEPT 27 1979	301	15.01	34	59	4.86	11	549	23.87	54	10	.26	1			P
SEPT 19 1980	150	7.48	20	113	9.30	25	480	20.87	55	8	.20	1	37.86	26.60*	P
JULY 04 1980	286	14.26	31	157	12.92	28	423	18.39	40	5	.14	0			P
AUG 26 1981	273	13.62	7	ND			E			ND					
MAY 11 1981	400	19.95	36	180	14.81	27	464	20.17	37	5	.13	0			P

ANIONS

STUDY & DATE	CL MG/L	CL EPM	CL %EPM	SO4 MG/L	SO4 EPM	SO4 %EPM	HCO3 MG/L	HCO3 EPM	HCO3 %EPM	CO3 MG/L	CO3 EPM	CO3 %EPM	ANION TOTAL	CATION TOTAL	
TBIGS FUEL															
JUNE 14 1979	33	.94	1	3790	78.88	98	54	.88	1	0	.00	0	80.69	49.88*	P
SEPT 27 1979	44	1.24	2	3450	71.80	98	ND			0	.00	0			
SEPT 19 1980	15	.42	2	1248	25.97	98	12	.20	1	0	.00	0	26.60	37.86*	P
JULY 04 1980	40	1.13	2	2920	60.77	98	ND			0	.00	0			
AUG 26 1981	48	1.35	2	2700	56.19	97	38	.62	1	0	.00	0			P
MAY 11 1981	60	1.69	2	3420	71.18	98	ND			0	.00	0			

* INDICATES ANION AND CATION TOTALS DON'T LIE WITHIN 10% OF EACH OTHER.

ND = Not determined
P = Plotted on Piper Diagram
E = Error

MAJOR ION CHEMISTRY

TYPE - WATER
LOCATION 14C

CATIONS

STUDY & DATE	CA MG/L	CA EPM	CA %EPM	MG MG/L	MG EPM	MG %EPM	NA MG/L	NA EPM	NA %EPM	K MG/L	K EPM	K %EPM	CATION TOTAL	ANION TOTAL	
TBIGS FUEL															
JUNE 14 1979	206	10.27	32	74	6.10	19	362	15.74	49	6	.15	0	32.27	44.72*	P
SEPT 27 1979	198	9.88	32	48	3.97	13	393	17.09	55	7	.18	1	31.11	38.59*	P
SEPT 19 1980	100	4.99	15	73	6.01	18	530	23.04	67	7	.18	1	34.22	42.33*	P
JULY 04 1980	289	14.41	35	89	7.30	18	435	18.91	46	5	.12	0			P
AUG 26 1981	196	9.78	26	ND			650	28.26	74	ND					
MAY 11 1981	350	17.46	38	110	9.05	20	432	18.78	41	3	.07	0	45.36	51.50*	P

ANIONS

STUDY & DATE	CL MG/L	CL EPM	CL %EPM	SO4 MG/L	SO4 EPM	SO4 %EPM	HCO3 MG/L	HCO3 EPM	HCO3 %EPM	CO3 MG/L	CO3 EPM	CO3 %EPM	ANION TOTAL	CATION TOTAL	
TBIGS FUEL															
JUNE 14 1979	18	.50	1	2040	42.46	95	107	1.76	4	0	.00	0	44.72	32.27*	P
SEPT 27 1979	22	.62	2	1740	36.21	94	107	1.76	5	0	.00	0	38.59	31.11*	P
SEPT 19 1980	34	.96	2	1935	40.27	95	67	1.10	3	0	.00	0	42.33	34.22*	P
JULY 04 1980	55	1.55	3	2240	46.62	97	ND			0	.00	0			
AUG 26 1981	28	.79	2	1530	31.84	95	62	1.02	3	0	.00	0			P
MAY 11 1981	48	1.35	3	2400	49.95	97	12	.20	0	0	.00	0	51.50	45.36*	P

* INDICATES ANION AND CATION TOTALS DON'T LIE WITHIN 10% OF EACH OTHER.

ND = Not determined
P = Plotted on Piper Diagram
E = Error

MAJOR ION CHEMISTRY

TBIGS FUEL
TYPE - WATER
LOCATION 15A

DATE	CATIONS CA MG/L	CA EPM	CA %EPM	MG MG/L	MG EPM	MG %EPM	NA MG/L	NA EPM	NA %EPM	K MG/L	K EPM	K %EPM	CATION TOTAL	ANION TOTAL	
SEPT 19 1980	30	1.50	13	64	5.27	46	99	4.30	38	12	.31	3	11.38	16.11*	P
JULY 04 1980	242	12.07	51	128	10.53	44	22	.97	4	12	32	1			P
AUG 26 1981	140	6.98	85	ND			29	1.26	15	ND					
MAY 11 1981	188	9.38	51	95	7.82	42	26	1.13	6	8	.20	1	18.53	19.93	P

DATE	ANIONS CL MG/L	CL EPM	CL %EPM	SO4 MG/L	SO4 EPM	SO4 %EPM	HCO3 MG/L	HCO3 EPM	HCO3 %EPM	CO3 MG/L	CO3 EPM	CO3 %EPM	ANION TOTAL	CATION TOTAL	
SEPT 19 1980	32	.90	6	208	4.33	27	664	10.88	68	0	.00	0	16.11	11.38*	P
JULY 04 1980	60	1.69	67	40	.83	33	ND			0	.00	0			P
AUG 26 1981	32	.90	6	155	3.23	20	717	11.76	74	0	.00	0			
MAY 11 1981	32	.90	5	21	.44	2	1135	18.59	93	0	.00	0	19.93	18.53	P

* INDICATES ANION AND CATION TOTALS DON'T LIE WITHIN 10% OF EACH OTHER.

ND = Not determined
P = Plotted on Piper Diagram
E = Error

MAJOR ION CHEMISTRY

TBIGS FUEL
TYPE - WATER
LOCATION 15B

DATE	CATIONS CA MG/L	CA EPM	CA %EPM	MG MG/L	MG EPM	MG %EPM	NA MG/L	NA EPM	NA %EPM	K MG/L	K EPM	K %EPM	CATION TOTAL	ANION TOTAL	
SEPT 19 1980	56	2.79	29	64	5.27	55	31	1.35	14	6	.15	2	9.56	16.03*	P
JULY 04 1980	164	8.18	53	52	4.24	27	68	2.97	19	6	.16	1			P
AUG 26 1981	162	8.08	86	ND			30	1.30	14	ND					
MAY 11 1981	195	9.73	58	70	5.76	34	28	1.22	7	2	.05	0			P

DATE	ANIONS CL MG/L	CL EPM	CL %EPM	SO4 MG/L	SO4 EPM	SO4 %EPM	HCO3 MG/L	HCO3 EPM	HCO3 %EPM	CO3 MG/L	CO3 EPM	CO3 %EPM	ANION TOTAL	CATION TOTAL	
SEPT 19 1980	53	1.49	9	21	.44	3	860	14.10	88	0	.00	0	16.03	9.56*	P
JULY 04 1980	78	2.18	78	30	.62	22	ND			0	.00	0			
AUG 26 1981	39	1.10	7	24	.50	3	822	13.48	89	0	.00	0			P
MAY 11 1981	95	2.68	69	0	00	0	ND			0	.00	0			

* INDICATES ANION AND CATION TOTALS DON'T LIE WITHIN 10% OF EACH OTHER.

ND - Not determined
P - Plotted on Piper Diagram
E - Error

MAJOR ION CHEMISTRY

TBIGS FUEL
TYPE - WATER
LOCATION 16A

DATE	CATIONS CA MG/L	CA EPM	CA %EPM	MG MG/L	MG EPM	MG %EPM	NA MG/L	NA EPM	NA %EPM	K MG/L	K EPM	K %EPM	CATION TOTAL	ANION TOTAL	
SEPT 19 1980	38	1.90	19	55	4.53	45	76	3.30	33	9	.23	2	9.96	14.45*	P
JULY 04 1980	104	5.19	44	47	3.83	33	62	2.70	23	2	.05	0			P
AUG 26 1981	43	2.14	57	ND			37	1.61	43	ND					
MAY 11 1981	77	3.84	43	47	3.87	44	23	1.00	11	5	.12	1	8.83	9.73	P

DATE	ANIONS CL MG/L	CL EPM	CL %EPM	SO4 MG/L	SO4 EPM	SO4 %EPM	HCO3 MG/L	HCO3 EPM	HCO3 %EPM	CO3 MG/L	CO3 EPM	CO3 %EPM	ANION TOTAL	CATION TOTAL	
SEPT 19 1980	34	.96	7	14	.29	2	805	13.20	91	0	.00	0	14.45	9.96*	P
JULY 04 1980	36	1.01	64	28	.58	36	ND			0	.00	0			
AUG 26 1981	28	.79	7	28	.58	5	584	9.58	87	0	.00	0			P
MAY 11 1981	33	.93	10	[illegible]			537	8.80	90	0	.00	0	9.73	8.83	P

* INDICATES ANION AND CATION TOTALS DON'T LIE WITHIN 10% OF EACH OTHER.

ND = Not determined
P = Plotted on Piper Diagram
E = Error

MAJOR ION CHEMISTRY

TBTGS FUEL
TYPE - WATER
LOCATION 16B

DATE	CATIONS CA MG/L	CA EPM	CA %EPM	MG MG/L	MG EPM	MG %EPM	NA MG/L	NA EPM	NA %EPM	K MG/L	K EPM	K %EPM	CATION TOTAL	ANION TOTAL	
SEPT 19 1980	67	3.34	30	73	6.01	55	34	1.48	13	6	.15	1	10.98	19.27*	P
JULY 04 1980	279	13.92	66	67	5.47	26	37	1.61	8	5	.12	1			P
AUG 26 1981	190	9.48	88	ND			31	1.35	12	ND					
MAY 11 1981	237	11.82	59	84	6.91	34	32	1.39	7	2	.05	0	20.18	20.08	P

DATE	ANIONS CL MG/L	CL EPM	CL %EPM	SO4 MG/L	SO4 EPM	SO4 %EPM	HCO3 MG/L	HCO3 EPM	HCO3 %EPM	CO3 MG/L	CO3 EPM	CO3 %EPM	ANION TOTAL	CATION TOTAL	
SEPT 19 1980	90	2.54	13	28	.58	3	986	16.16	84	0	.00	0	19.27	10.98*	P
JULY 04 1980	143	4.03	89	23	.48	11	ND			0	.00	0			P
AUG 26 1981	71	2.00	13	16	.33	2	827	13.56	85	0	.00	0			
MAY 11 1981	160	4.51	22	9	.18	1	939	15.40	77	0	.00	0	20.08	20.18	P

* INDICATES ANION AND CATION TOTALS DON'T LIE WITHIN 10% OF EACH OTHER.

ND = Not determined
P = Plotted on Piper Diagram
E = Error

MAJOR ION CHEMISTRY

TBTGS FUEL
TYPE - WATER
LOCATION 17A

DATE	CATIONS CA MG/L	CA EPM	CA %EPM	MG MG/L	MG EPM	MG %EPM	NA MG/L	NA EPM	NA %EPM	K MG/L	K EPM	K %EPM	CATION TOTAL	ANION TOTAL	
SEPT 19 1980	53	2.64	16	53	4.36	26	211	9.17	55	15	.38	2	16.56	17.17	P
JULY 04 1980	141	/.03	48	69	5.71	39	34	1.49	10	14	35	2			P
AUG 26 1981	68	3.39	21	ND			297	12.91	79	ND					
MAY 11 1981	135	6.73	43	62	5.10	33	76	3.30	21	16	.41	3	15.55	16.70	P

DATE	ANIONS CL MG/L	CL EPM	CL %EPM	SO4 MG/L	SO4 EPM	SO4 %EPM	HCO3 MG/L	HCO3 EPM	HCO3 %EPM	CO3 MG/L	CO3 EPM	CO3 %EPM	ANION TOTAL	CATION TOTAL	
SEPT 19 1980	53	1.49	9	152	3.16	18	764	12.52	73	0	.00	0	17.17	16.56	P
JULY 04 1980	90	2.54	84	24	.50	16	ND			0	.00	0			P
AUG 26 1981	29	.82	4	32	.67	3	1183	19.39	93	0	.00	0			
MAY 11 1981	86	2.42	15	4	.08	0	866	14.20	85	0	.00	0	16.70	15.55	P

* INDICATES ANION AND CATION TOTALS DON'T LIE WITHIN 10% OF EACH OTHER.

ND = Not determined
P = Plotted on Piper Diagram
E = Error

MAJOR ION CHEMISTRY

TBIGS FUEL
TYPE - WATER
LOCATION 17B

	CATIONS												CATION TOTAL	ANION TOTAL	
	CA			MG			NA			K					
DATE	MG/L	EPM	%EPM	MG/L	EPM	%EPM	MG/L	EPM	%EPM	MG/L	EPM	%EPM			
SEPT 19 1980	56	2.79	28	68	5.60	56	34	1.48	15	8	.20	2	10.07	13.10*	P
JULY 04 1980	217	10.82	62	63	5.18	30	27	1.17	7	6	.16	1			P
AUG 26 1981	138	6.88	79	ND			43	1.87	21	ND					

	ANIONS												ANION TOTAL	CATION TOTAL	
	CL			SO4			HCO3			CO3					
DATE	MG/L	EPM	%EPM	MG/L	EPM	%EPM	MG/L	EPM	%EPM	MG/L	EPM	%EPM			
SEPT 19 1980	87	2.45	19	18	.37	3	627	10.28	78	0	.00	0	13.10	10.07*	P
JULY 04 1980	115	3.24	89	19	.40	11	ND			0	.00	0			
AUG 26 1981	40	1.13	6	400	8.32	41	672	11.02	54	0	.00	0			P

* INDICATES ANION AND CATION TOTALS DON'T LIE WITHIN 10% OF EACH OTHER.

ND = Not determined
P = Plotted on Piper Diagram
E = Error

MAJOR ION CHEMISTRY

TBTGS FUEL
TYPE - WATER
LOCATION 18A

CATIONS

DATE	CA MG/L	CA EPM	CA %EPM	MG MG/L	MG EPM	MG %EPM	NA MG/L	NA EPM	NA %EPM	K MG/L	K EPM	K %EPM	CATION TOTAL	ANION TOTAL	
SEPT 19 1980	95	4.74	4	ND			191	8.30	6	5	.13	0			
JULY 04 1980	305	15.21	68	58	4.81	22	45	1.97	9	12	.29	1			P
AUG 26 1981	377	18.80	70	ND			188	8.17	30	ND					
MAY 11 1981	ND			ND			ND			ND					

ANIONS

DATE	CL MG/L	CL EPM	CL %EPM	SO4 MG/L	SO4 EPM	SO4 %EPM	HCO3 MG/L	HCO3 EPM	HCO3 %EPM	CO3 MG/L	CO3 EPM	CO3 %EPM	ANION TOTAL	CATION TOTAL	
SEPT 19 1980	34	.96	2	1926	40.08	97	15	.24	1	0	.00	0			
JULY 04 1980	49	1.38	14	420	8.74	86	ND			0	.00	0			P
AUG 26 1981	31	.87	2	1750	36.42	96	49	.80	2	0	.00	0			
MAY 11 1981	35	.99	2	2500	52.03	98	7	.12	0	0	.00	0			

* INDICATES ANION AND CATION TOTALS DON'T LIE WITHIN 10% OF EACH OTHER.

ND = Not determined
P = Plotted on Piper Diagram
E = Error

MAJOR ION CHEMISTRY

TBTGS FUEL
TYPE - WATER
LOCATION 18B

CATIONS

DATE	CA MG/L	CA EPM	CA %EPM	MG MG/L	MG EPM	MG %EPM	NA MG/L	NA EPM	NA %EPM	K MG/L	K EPM	K %EPM	CATION TOTAL	ANION TOTAL	
SEPT 19 1980	130	6.48	21	192	15.80	52	179	7.78	26	7	.18	1			P
JULY 04 1980	137	6.83	67	34	2.77	27	ND			2	.05	1			
AUG 26 1981	344	17.16	68	ND			189	8.22	32	ND					
MAY 11 1981	500	24.94	53	200	16.46	35	132	5.74	12	4	.10	0			P

ANIONS

DATE	CL MG/L	CL EPM	CL %EPM	SO4 MG/L	SO4 EPM	SO4 %EPM	HCO3 MG/L	HCO3 EPM	HCO3 %EPM	CO3 MG/L	CO3 EPM	CO3 %EPM	ANION TOTAL	CATION TOTAL	
SEPT 19 1980	48	1.35	8	786	16.36	92	ND			0	.00	0			
JULY 04 1980	60	1.69	68	E			ND			0	.00	0			
AUG 26 1981	57	1.61	4	2000	41.62	95	46	.76	2	0	.00	0			P
MAY 11 1981	41	1.15	2	3000	62.43	98	ND			0	.00	0			

* INDICATES ANION AND CATION TOTALS DON'T LIE WITHIN 10% OF EACH OTHER.

ND = Not determined
P = Plotted on Piper Diagram
E = Error

MAJOR ION CHEMISTRY

TBIGS FUEL
TYPE - WATER
LOCATION 19A

CATIONS

DATE	CA MG/L	CA EPM	CA %EPM	MG MG/L	MG EPM	MG %EPM	NA MG/L	NA EPM	NA %EPM	K MG/L	K EPM	K %EPM	CATION TOTAL	ANION TOTAL
SEPT 19 1980	E			96	7.90	34	313	13.61	58	10	.26	1		
JULY 04 1980	ND			ND			ND			ND				
AUG 26 1981	437	21.80	41	ND			725	31.52	59	ND				
MAY 11 1981	370	18.45	40	170	13.99	31	298	12.96	28	9	.23	1		

ANIONS

DATE	CL MG/L	CL EPM	CL %EPM	SO4 MG/L	SO4 EPM	SO4 %EPM	HCO3 MG/L	HCO3 EPM	HCO3 %EPM	CO3 MG/L	CO3 EPM	CO3 %EPM	ANION TOTAL	CATION TOTAL
SEPT 19 1980	30	.85	10	E			83	1.36	16	0	.00	0		
JULY 04 1980	37	1.04	2	2400	49.95	98	ND			0	.00	0		
AUG 26 1981	35	.99	2	2150	44.75	98	5	.08		0	.00	0		
MAY 11 1981	41	1.15	100	0	.00		ND			0	.00	0		

P

* INDICATES ANION AND CATION TOTALS DON'T LIE WITHIN 10% OF EACH OTHER.

ND = Not determined
P = Plotted in Piper Diagram
E = Error

MAJOR ION CHEMISTRY

TBTGS FUEL
TYPE - WATER
LOCATION 19B

	CATIONS												CATION TOTAL	ANION TOTAL	
	CA			MG			NA			K					
DATE	MG/L	EPM	%EPM	MG/L	EPM	%EPM	MG/L	EPM	%EPM	MG/L	EPM	%EPM			
SEPT 19 1980	125	6.23	5	E			350	15.22	12	6	.15	0			
JULY 04 1980	444	22.14	44	234	19.26	38	195	8.48	17	7	.17	0			P
AUG 26 1981	224	11.17	40	ND			388	16.87	60	ND					
MAY 11 1981	320	15.96	35	180	14.81	32	340	14.78	32	3	.08	0			P

	ANIONS												ANION TOTAL	CATION TOTAL	
	CL			SO4			HCO3			CO3					
DATE	MG/L	EPM	%EPM	MG/L	EPM	%EPM	MG/L	EPM	%EPM	MG/L	EPM	%EPM			
SEPT 19 1980	50	1.41	32	E			ND			0	.00	0			
JULY 04 1980	50	1.41	2	3260	67.85	98	ND			0	.00	0			
AUG 26 1981	59	1.66	3	2586	53.82	96	37	.60	1	0	.00	0			P
MAY 11 1981	53	1.49	2	3120	64.93	98	ND			0	.00	0			

* INDICATES ANION AND CATION TOTALS DON'T LIE WITHIN 10% OF EACH OTHER.

ND = Not determined
P = Plotted on Piper Diagram
E = Error

MAJOR ION CHEMISTRY

TBTGS FUEL
TYPE - WATER
LOCATION 20A

DATE	CATIONS CA MG/L	CA EPM	CA %EPM	MG MG/L	MG EPM	MG %EPM	NA MG/L	NA EPM	NA %EPM	K MG/L	K EPM	K %EPM	CATION TOTAL	ANION TOTAL	
SEPT 19 1980	66	3.29	34	35	2.88	30	74	3.22	33	12	.31	3	9.70	10.40	P
JULY 04 1980	450	22.44	48	153	12.59	27	257	11.17	24	9	.22	0			P
MAY 11 1981	274	13.67	66	28	2.30	11	100	4.35	21	11	.29	1	20.61	22.07	P

DATE	ANIONS CL MG/L	CL EPM	CL %EPM	SO4 MG/L	SO4 EPM	SO4 %EPM	HCO3 MG/L	HCO3 EPM	HCO3 %EPM	CO3 MG/L	CO3 EPM	CO3 %EPM	ANION TOTAL	CATION TOTAL	
SEPT 19 1980	48	1.35	13	162	3.37	32	346	5.68	55	0	.00	0	10.40	9.70	P
JULY 04 1980	50	1.41	3	2560	53.28	97	ND			0	.00	0			
MAY 11 1981	45	1.27	6	740	15.40	70	329	5.40	24	0	.00	0	22.07	20.61	P

* INDICATES ANION AND CATION TOTALS DON'T LIE WITHIN 10% OF EACH OTHER.

ND = Not determined
P = Plotted on Piper Diagram
E = Error

MAJOR ION CHEMISTRY

TBTCS FUEL
TYPE - WATER
LOCATION 20B

DATE	CATIONS CA MG/L	CA EPM	CA %EPM	MG MG/L	MG EPM	MG %EPM	NA MG/L	NA EPM	NA %EPM	K MG/L	K EPM	K %EPM	CATION TOTAL	ANION TOTAL	
SEPT 19 1980	97	4.84	31	57	4.69	30	132	5.74	37	9	.23	1	15.50	8.23*	P
JULY 04 1980	283	14.11	36	157	12.92	33	272	11.83	30	5	.13	0			P
MAY 11 1981	116	5.79	64	32	2.63	29	13	.57	6	2	.04	0	9.02	9.33	P

DATE	ANIONS CL MG/L	CL EPM	CL %EPM	SO4 MG/L	SO4 EPM	SO4 %EPM	HCO3 MG/L	HCO3 EPM	HCO3 %EPM	CO3 MG/L	CO3 EPM	CO3 %EPM	ANION TOTAL	CATION TOTAL	
SEPT 19 1980	46	1.30	16	16	.33	4	403	6.60	80	0	.00	0	8.23	15.50*	P
JULY 04 1980	45	1.25	2	2800	58 27	98	ND								
MAY 11 1981	45	1.27	14	3	.06	1	488	8.00	86	0	.00	0	9.33	9.02	P

* INDICATES ANION AND CATION TOTALS DON'T LIE WITHIN 10% OF EACH OTHER.

ND - Not determined
P - Plotted
E - Error

831130

FIGURE A7

PIPER DIAGRAM

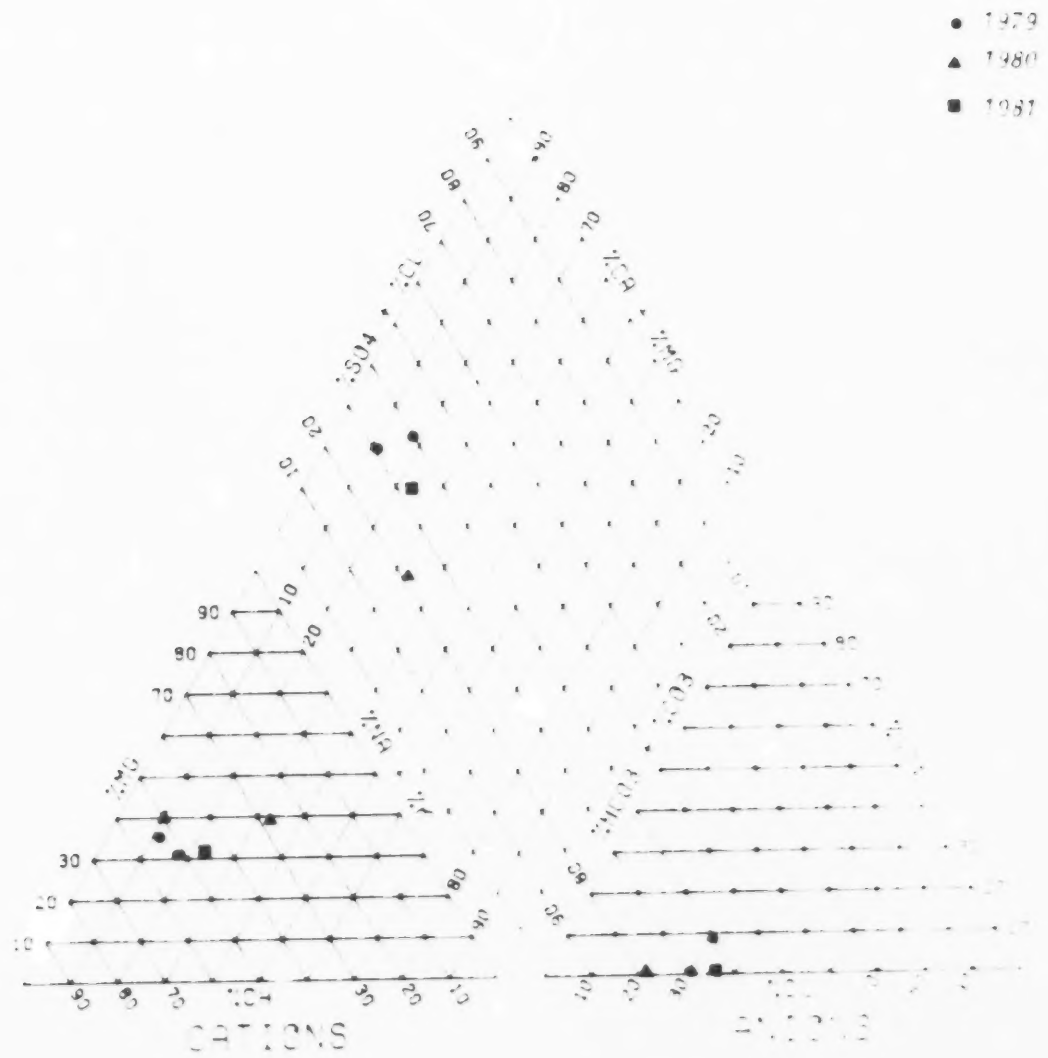
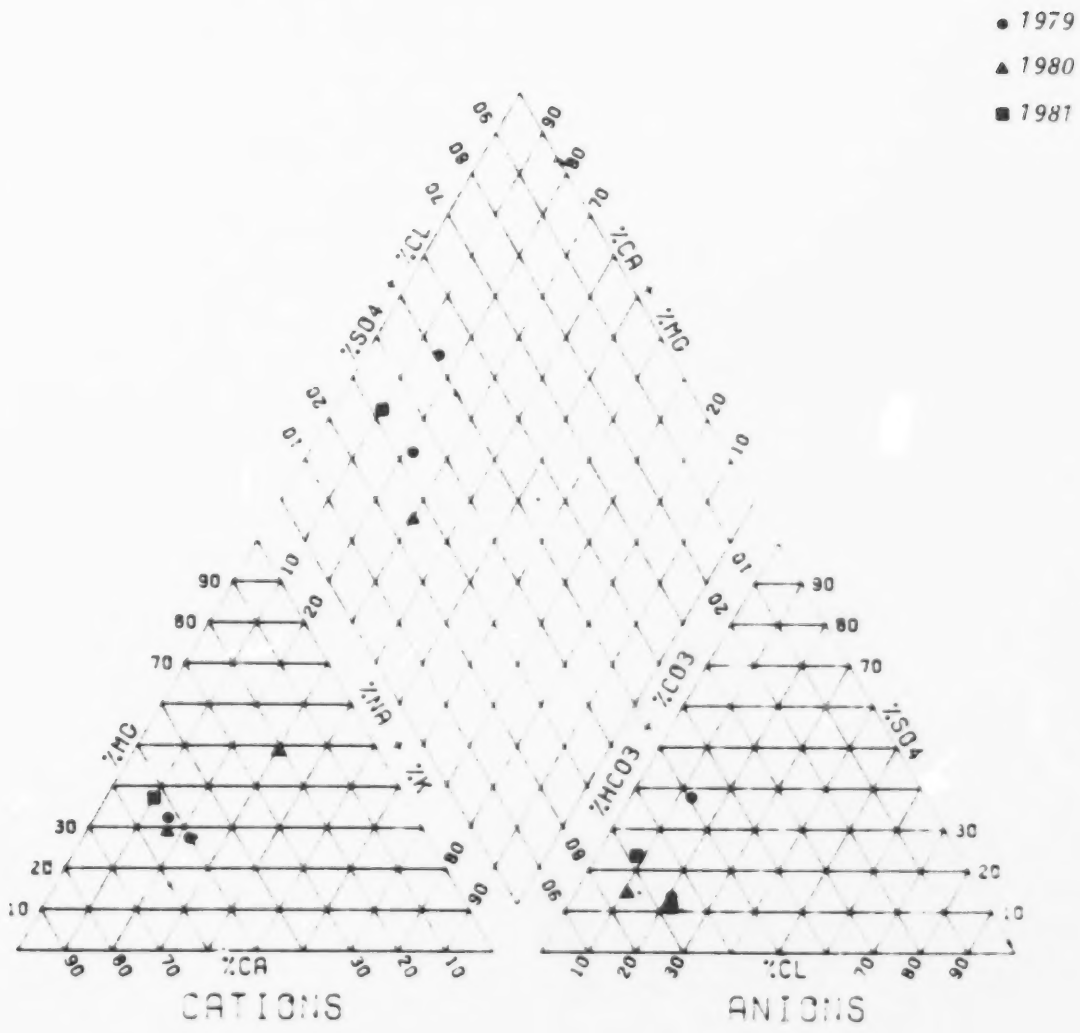


FIGURE A8

PIPER DIAGRAM

MAJOR ION CHEMISTRY
TBTGS FUEL
TYPE - WATER
LOCATION 04A



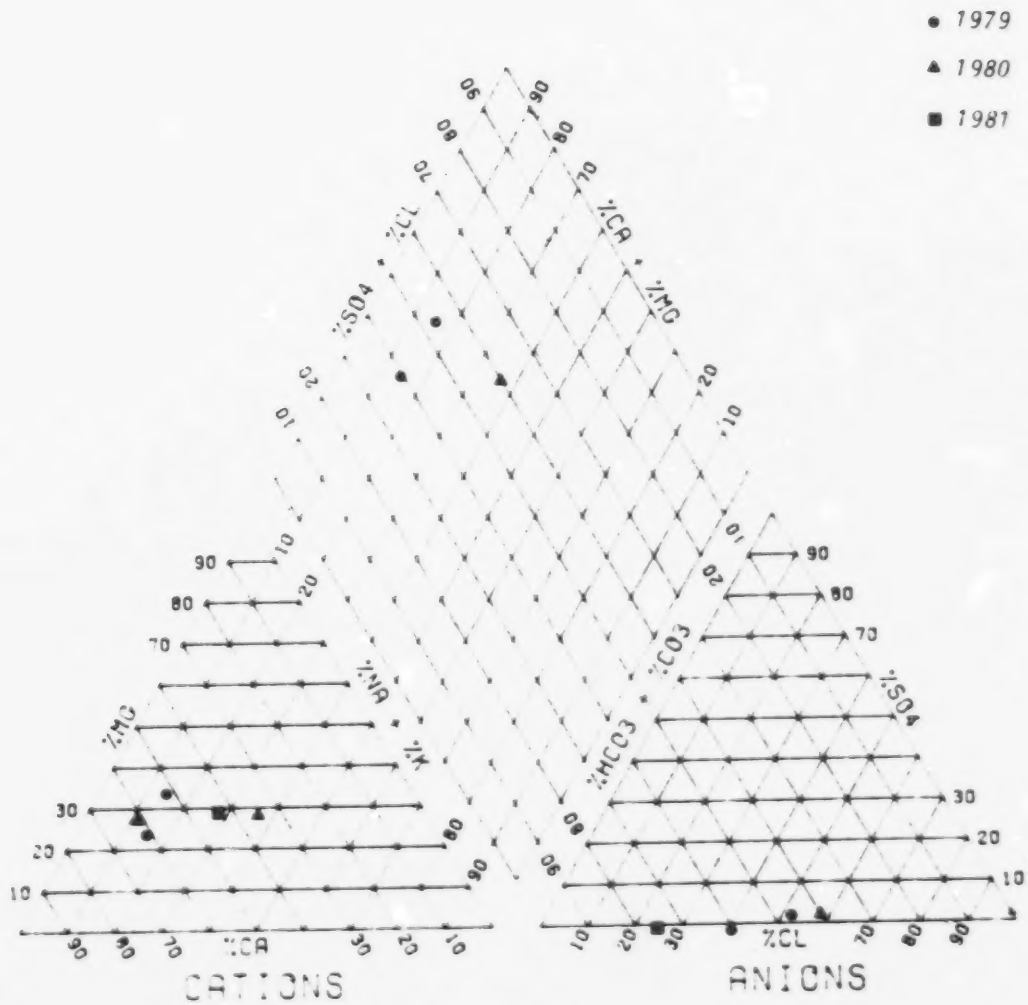
83-130

159770 RD

FIGURE A9

PIPER DIAGRAM

MAJOR ION CHEMISTRY
TBTGS FUEL
TYPE - WATER
LOCATION 05C

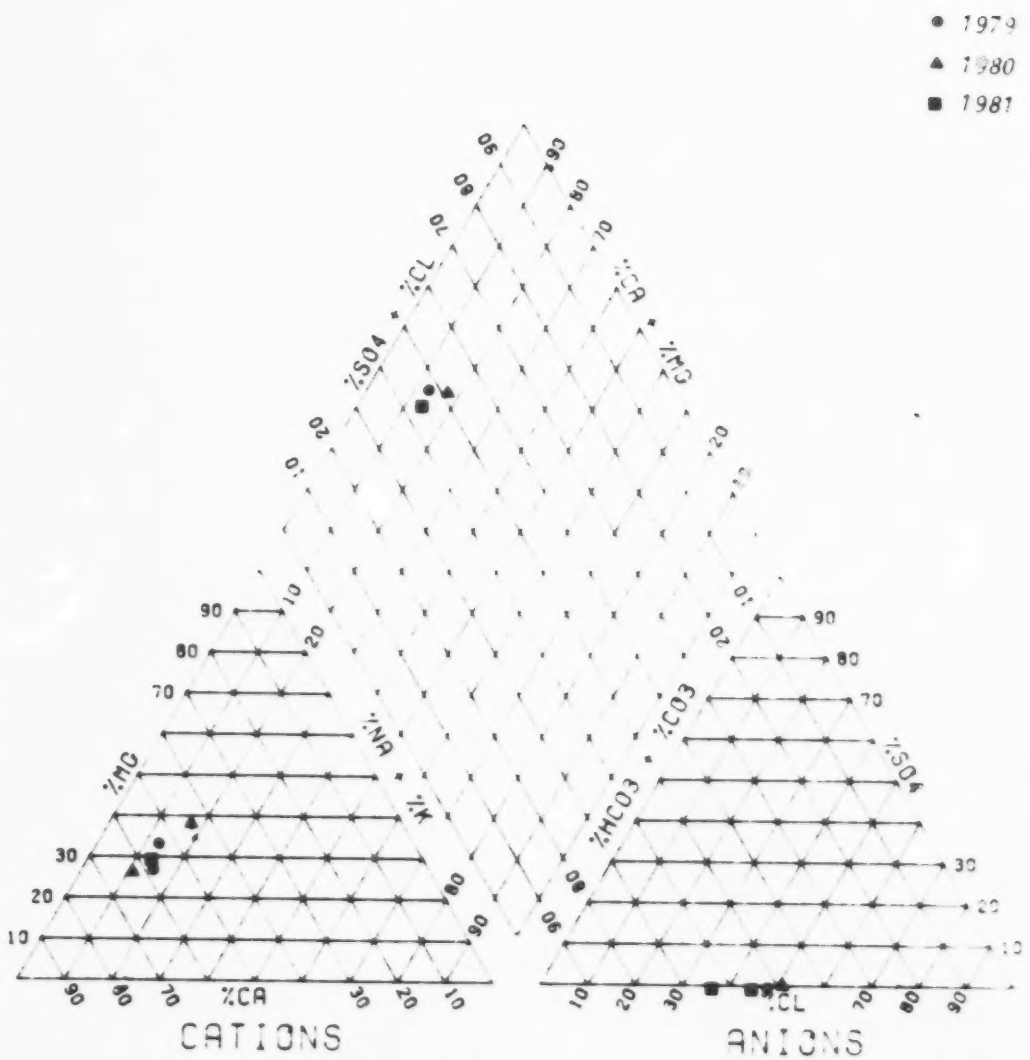


83-130

159771 RD

FIGURE A10

PIPER DIAGRAM

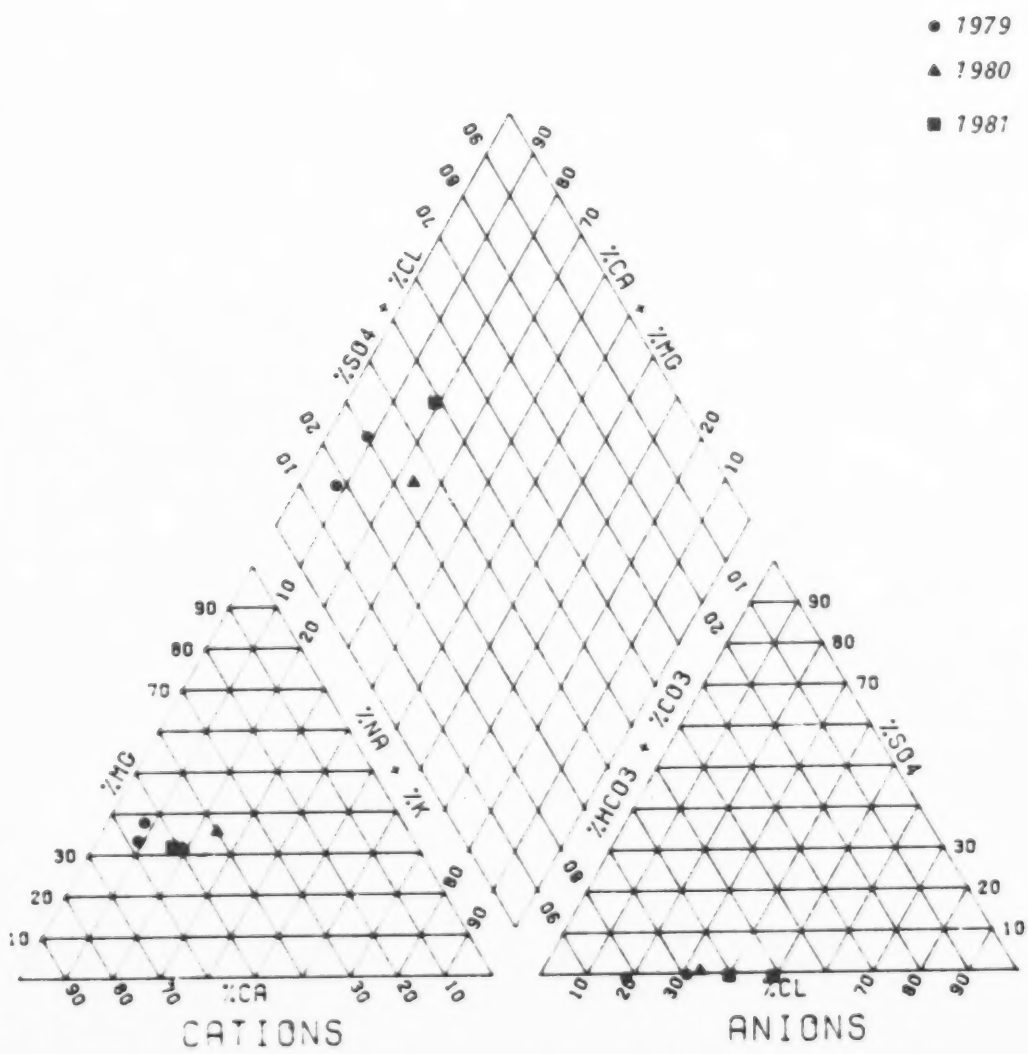


83-130

159772 RD

FIGURE A11
PIPER DIAGRAM

MAJOR ION CHEMISTRY
TBTGS FUEL
TYPE - WATER
LOCATION 06C

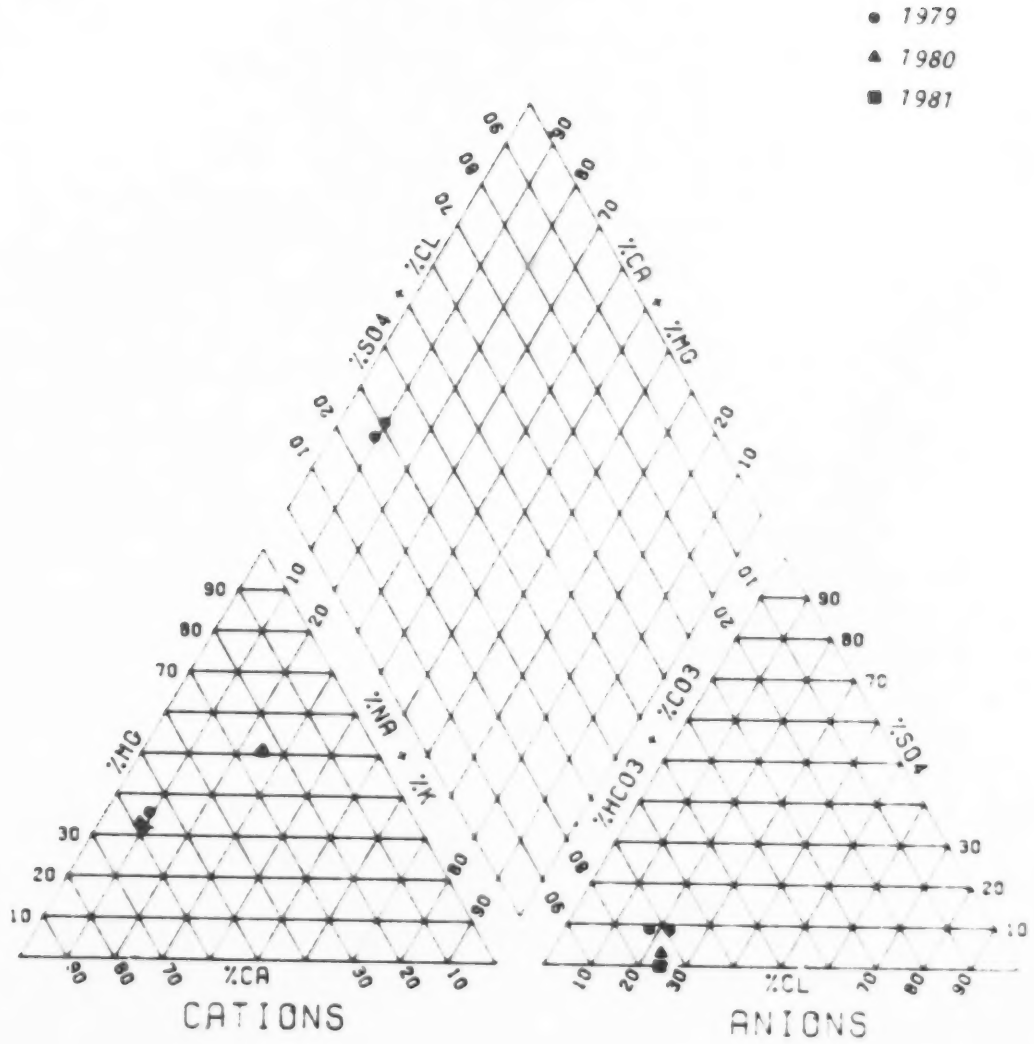


83-130

159773 RD

FIGURE A12
PIPER DIAGRAM

MAJOR ION CHEMISTRY
TBTGS FUEL
TYPE - WATER
LOCATION 07B



83-130

159774 RD

FIGURE A13

PIPER DIAGRAM

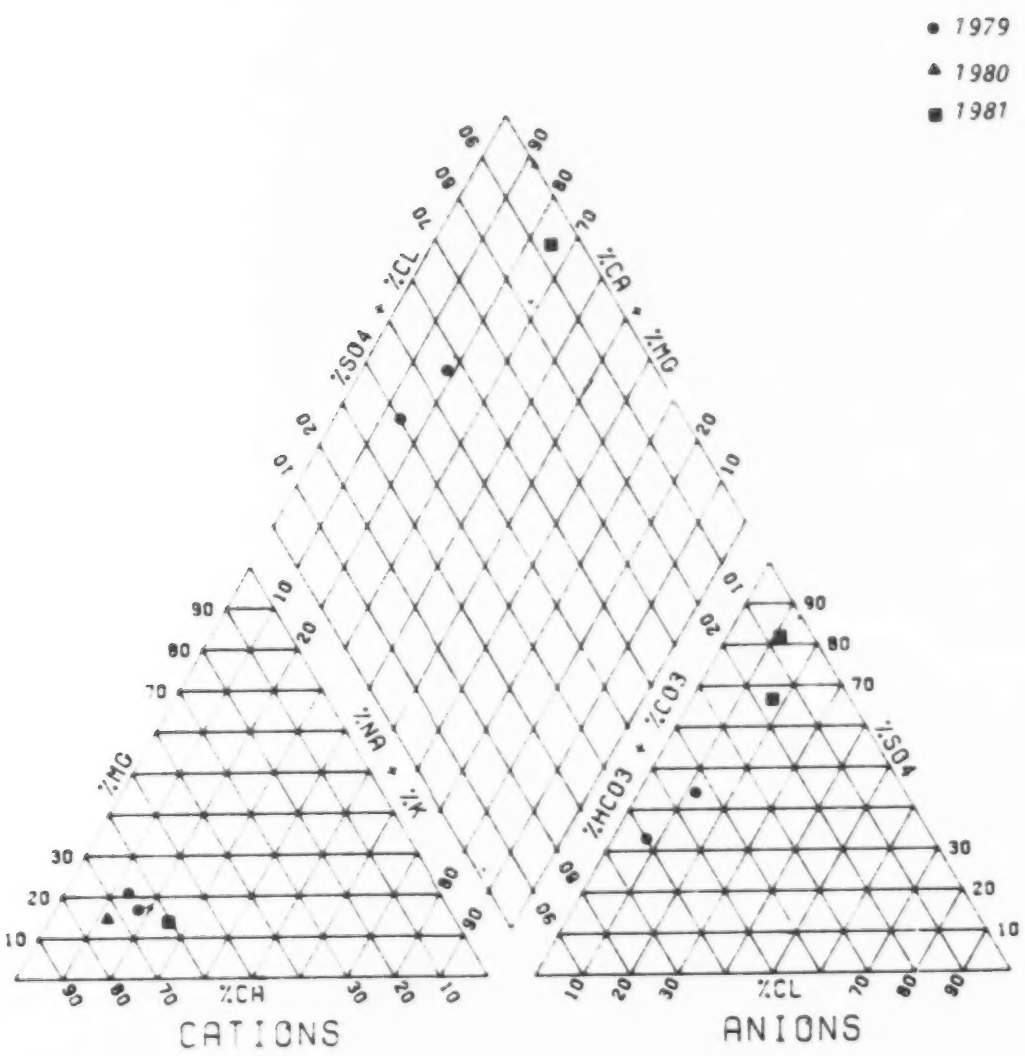
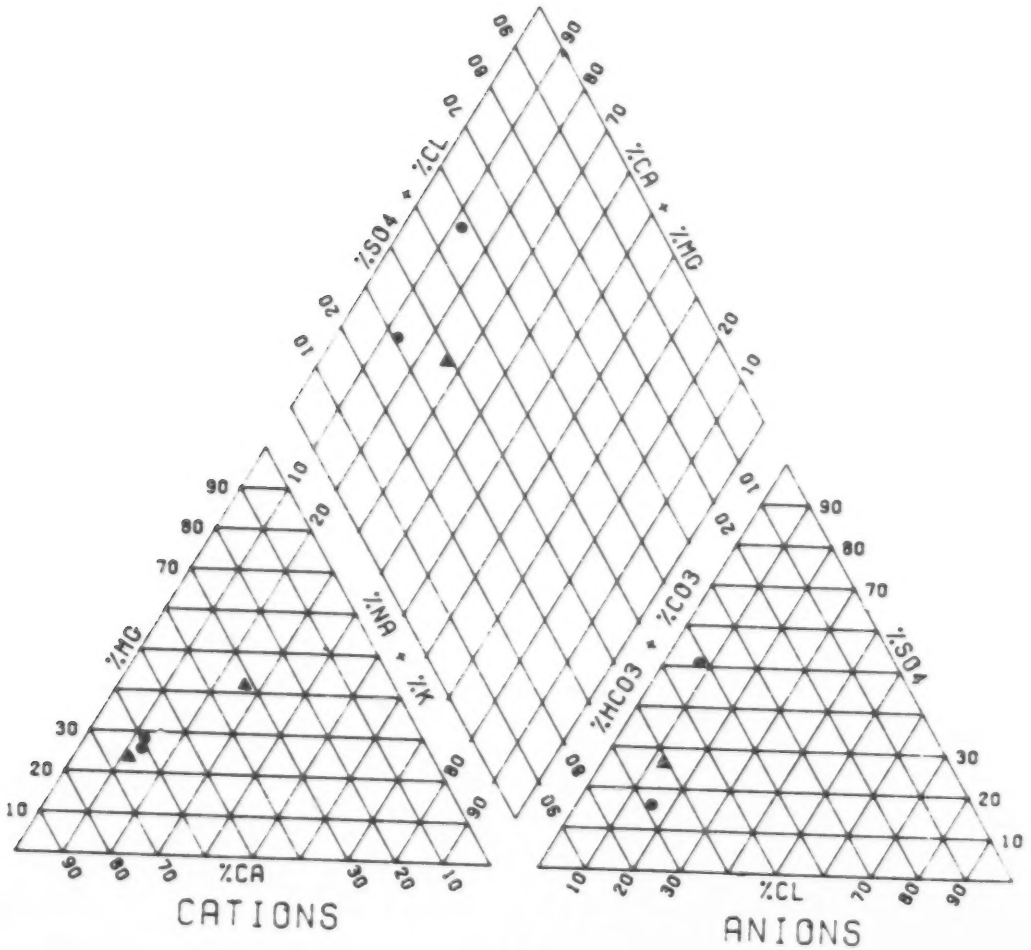


FIGURE A14

PIPER DIAGRAM

MAJOR ION CHEMISTRY
TBTGS FUEL
TYPE - WATER
LOCATION 10B

• 1979
▲ 1980



83-130

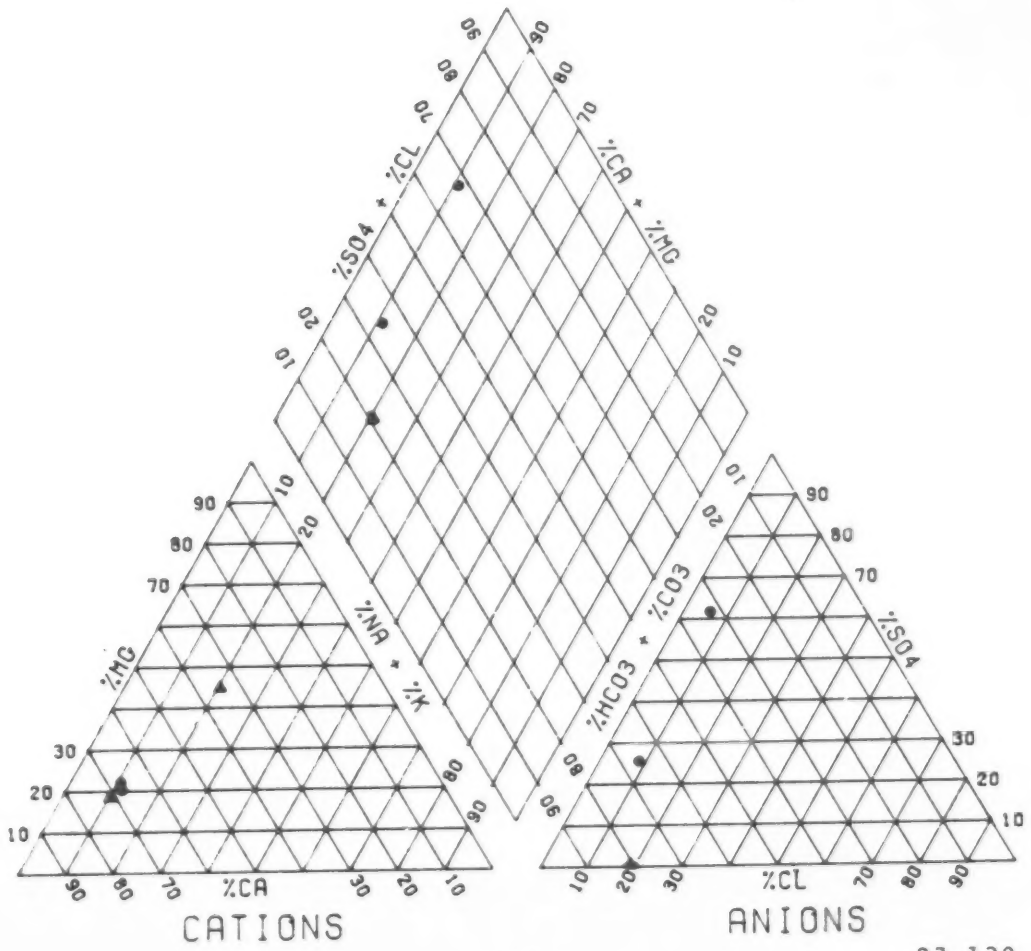
159776 RD

FIGURE A15

PIPER DIAGRAM

MAJOR ION CHEMISTRY
TBTGS FUEL
TYPE - WATER
LOCATION 10C

● 1979
▲ 1980



83-130

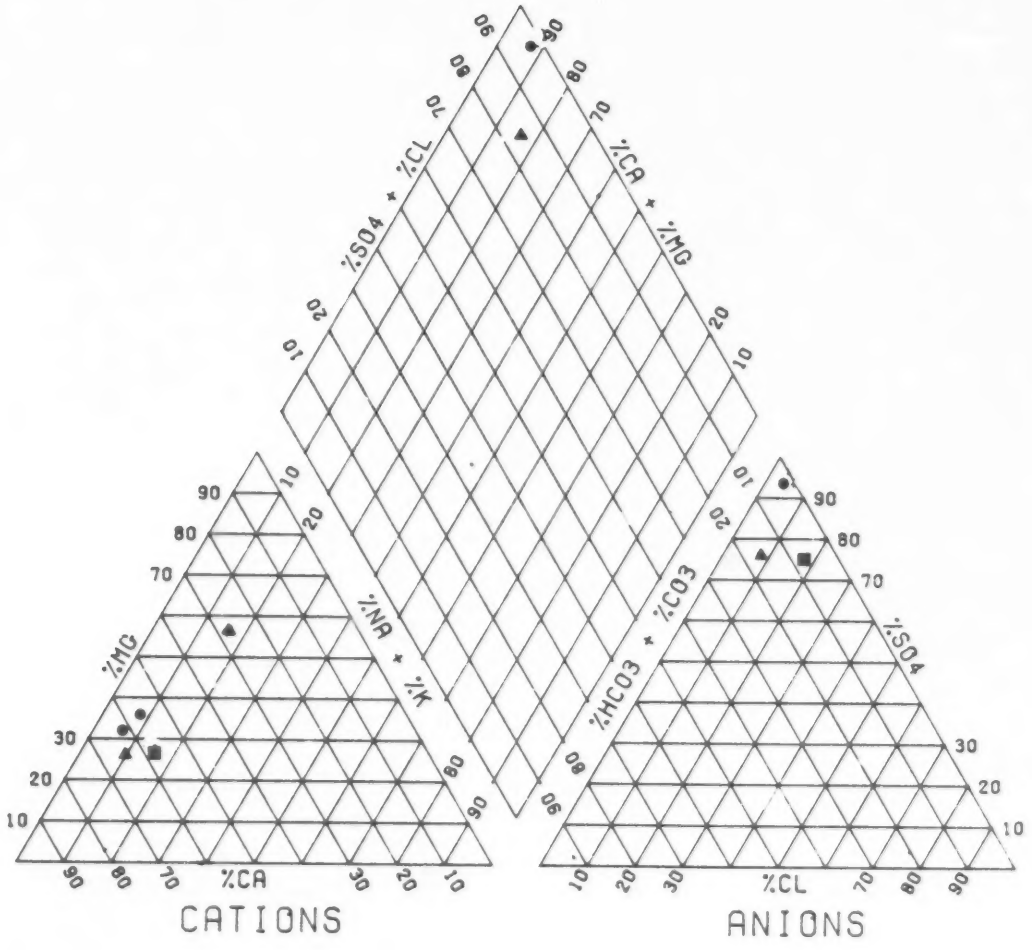
159777 RD

FIGURE A16

PIPER DIAGRAM

MAJOR ION CHEMISTRY
TBTGS FUEL
TYPE - WATER
LOCATION 12C

- 1979
- 1980
- 1981



83-130

159778 RD

FIGURE A17

PIPER DIAGRAM

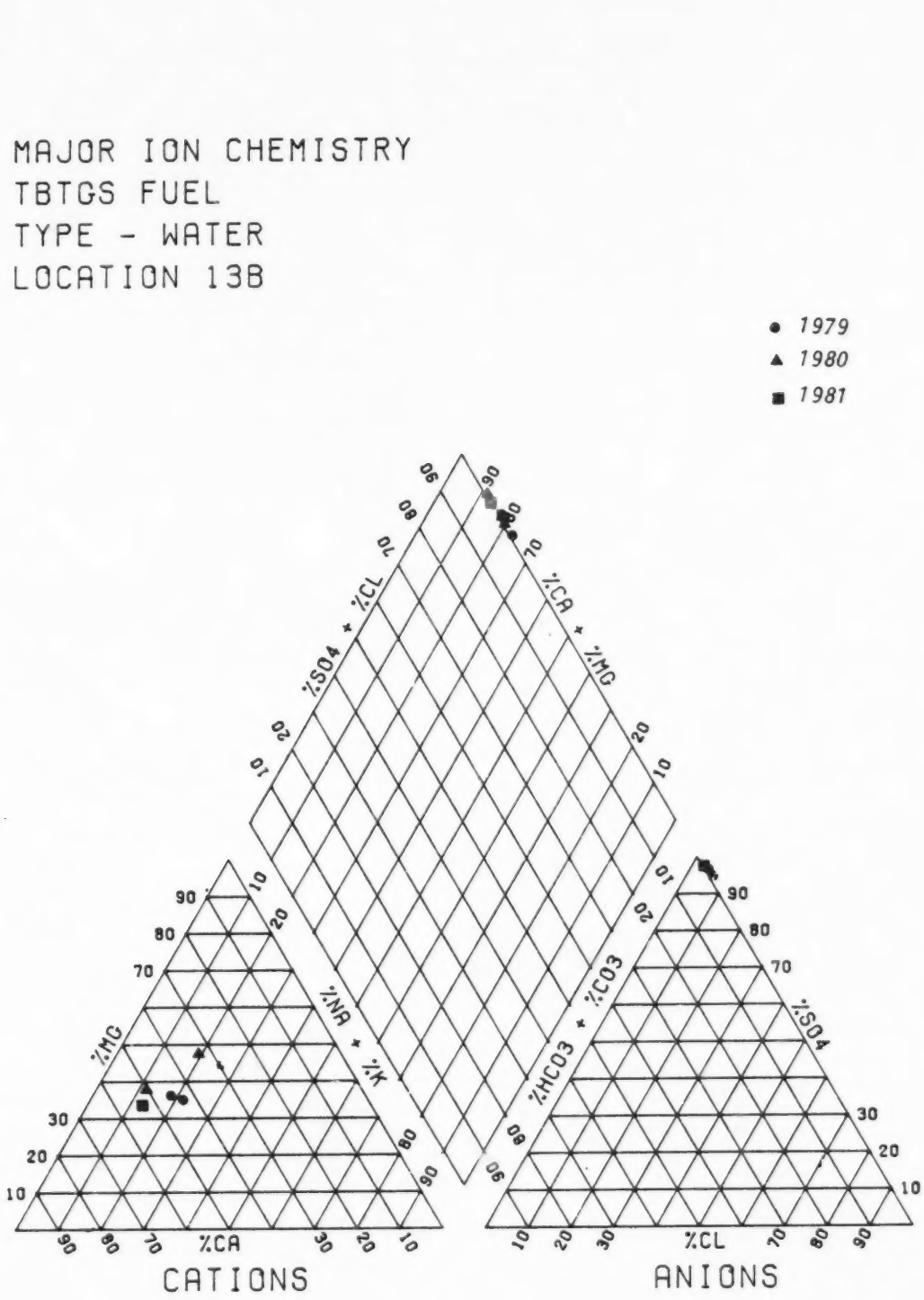
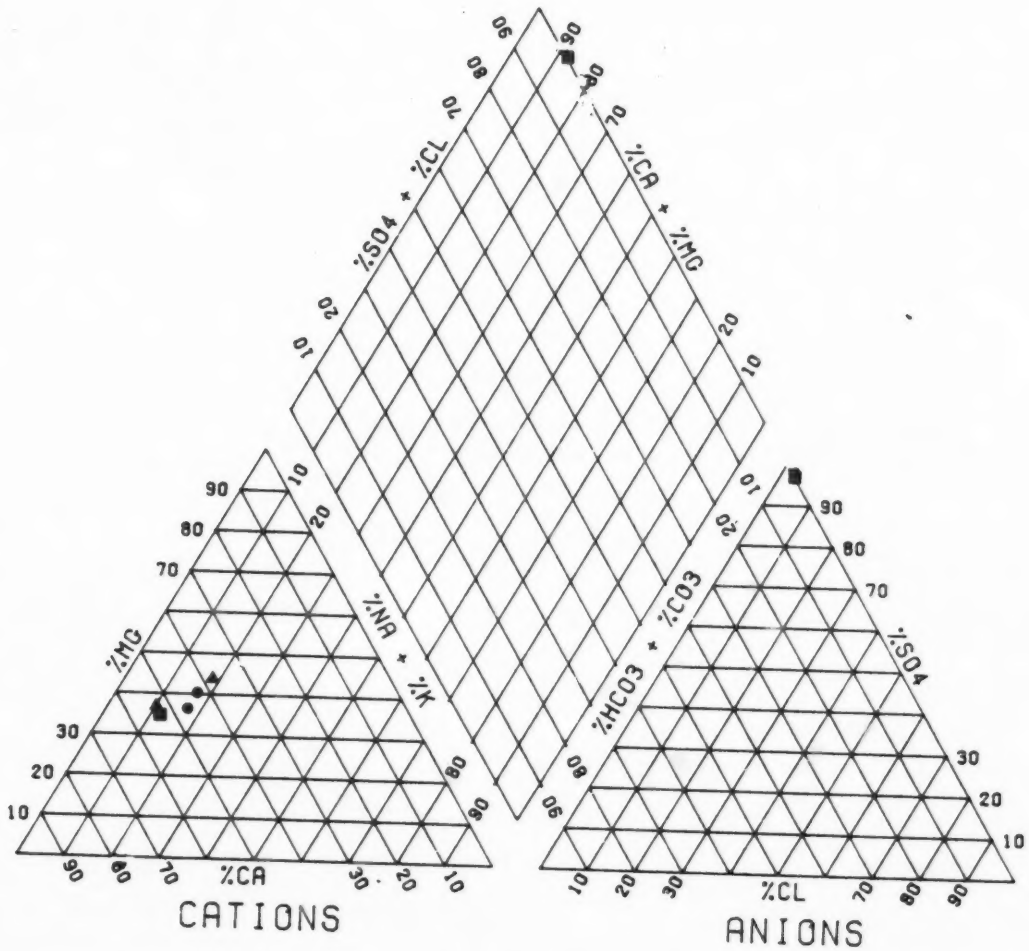


FIGURE A18

PIPER DIAGRAM



83-130

159780 RD

FIGURE A19

PIPER DIAGRAM

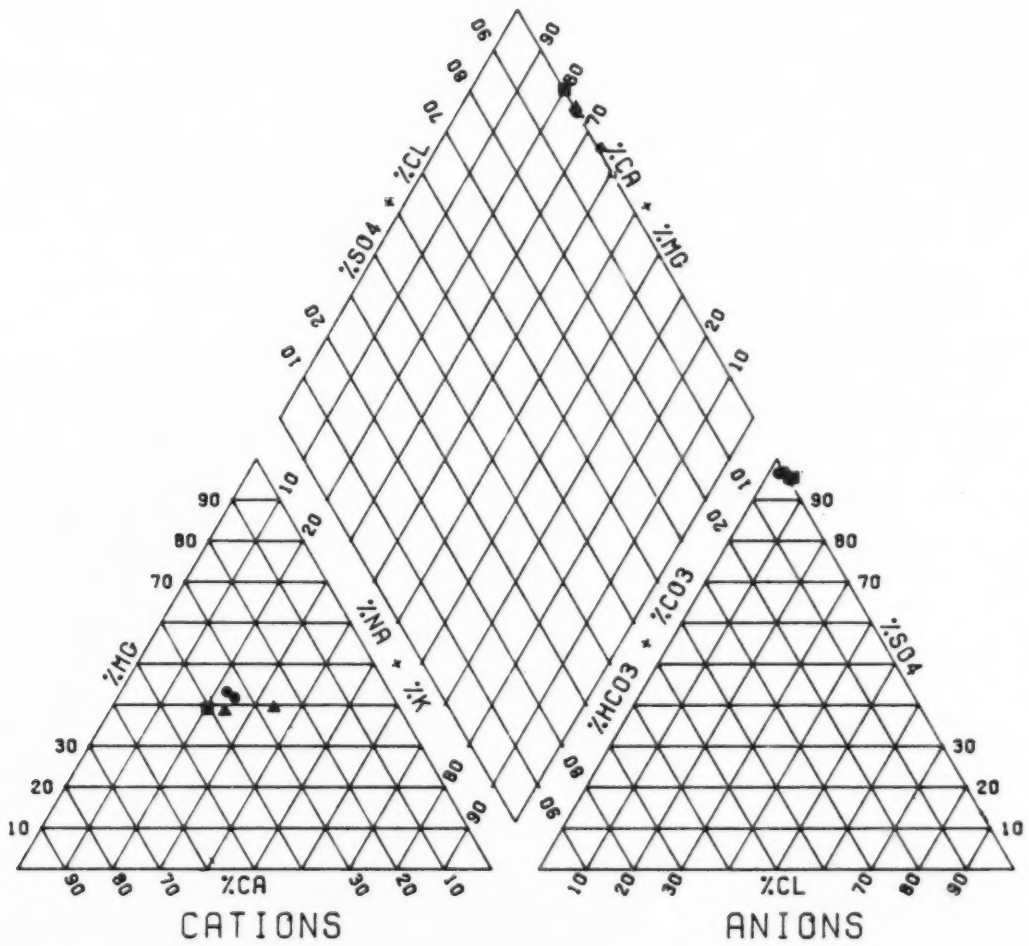
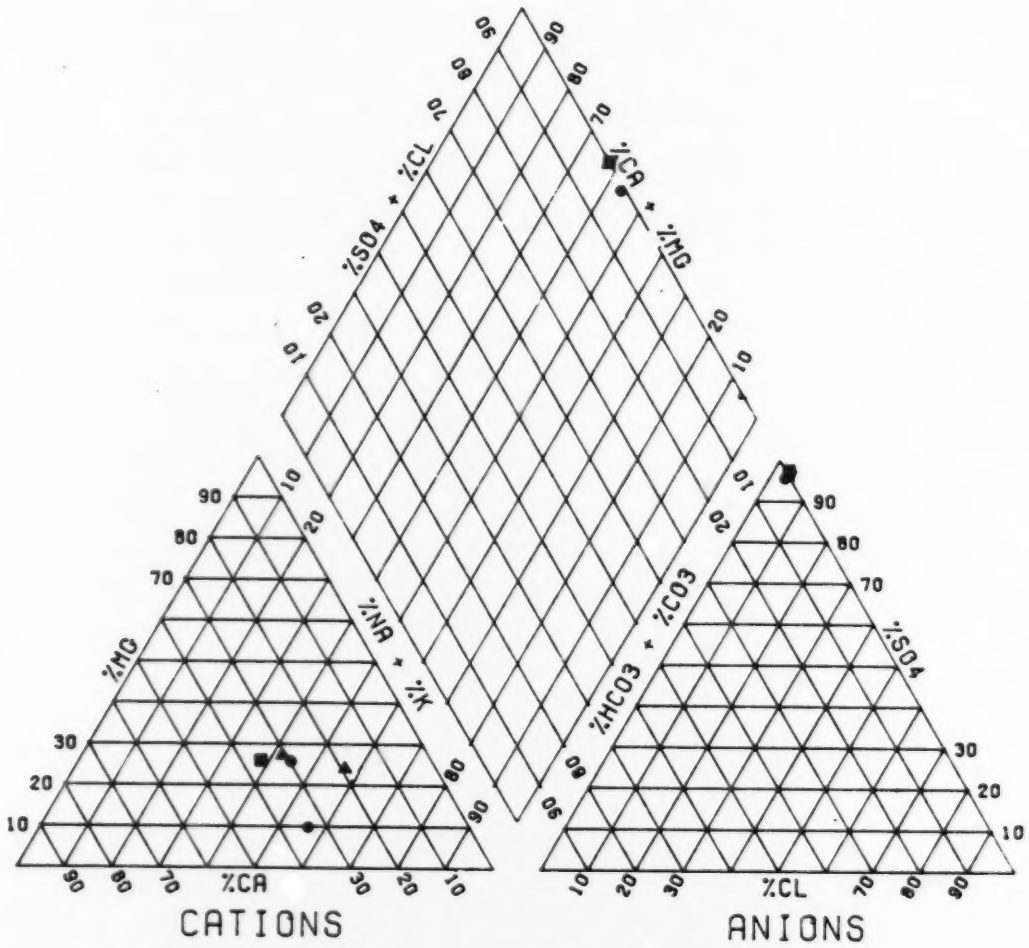


FIGURE A20

PIPER DIAGRAM

MAJOR ION CHEMISTRY
TBTGS FUEL
TYPE - WATER
LOCATION 14B

- 1979
- 1980
- 1981



83-130

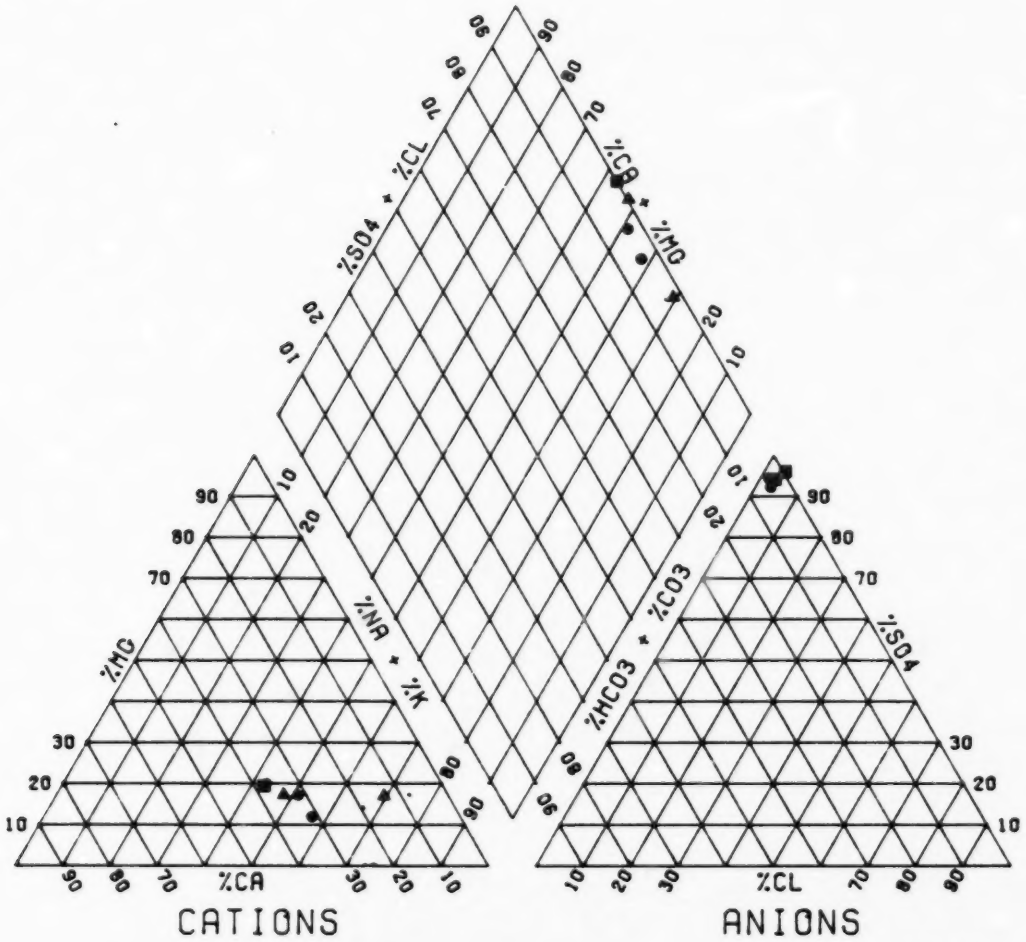
159782 RD

FIGURE A21

PIPER DIAGRAM

MAJOR ION CHEMISTRY
TBTGS FUEL
TYPE - WATER
LOCATION 14C

● 1979
▲ 1980
■ 1981



83-130

159783 RD

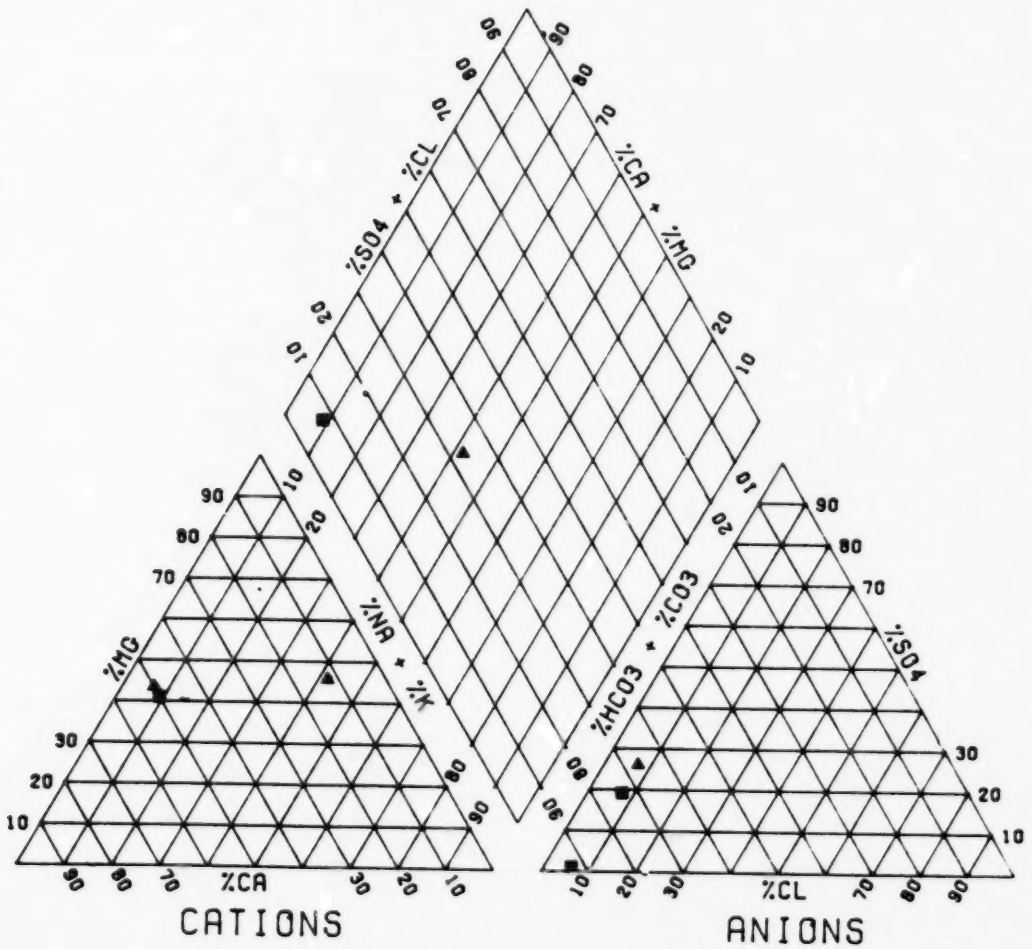
FIGURE A22

PIPER DIAGRAM

MAJOR ION CHEMISTRY
TBTGS FUEL
TYPE - WATER
LOCATION 15A

▲ 1980

■ 1981



83-130

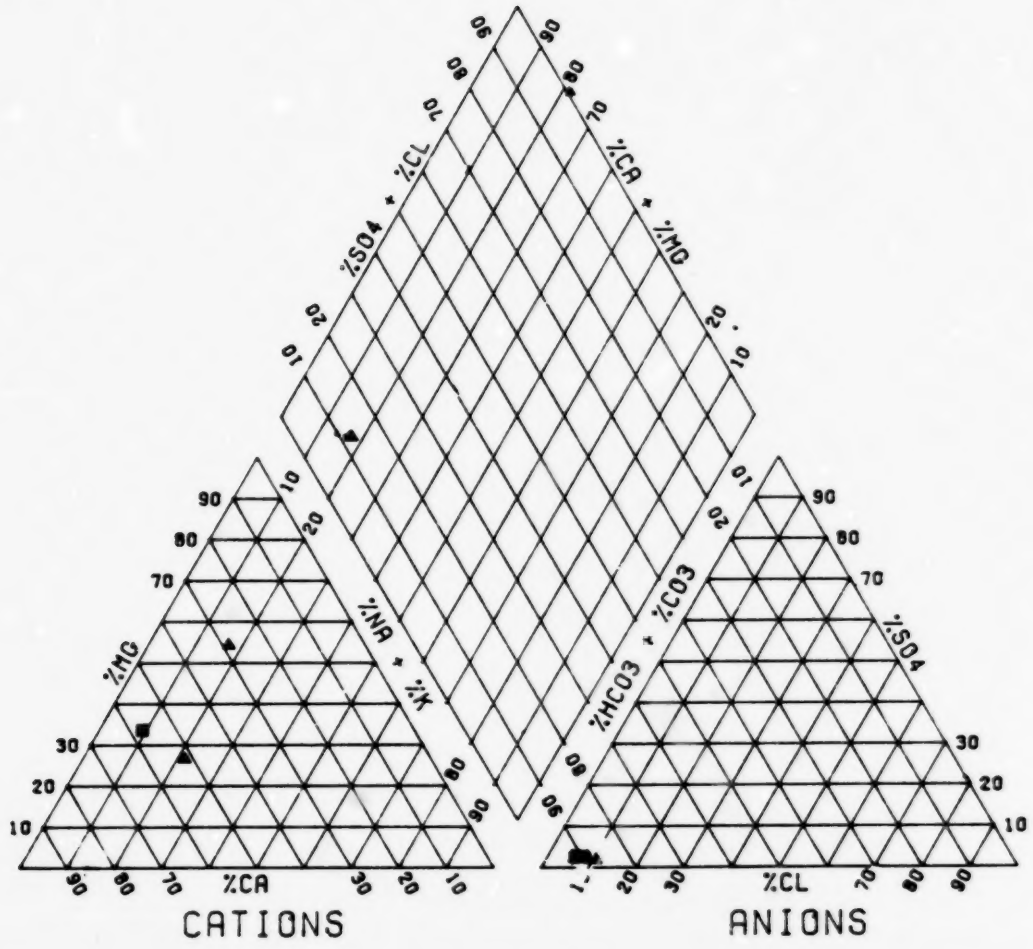
159784 RD

FIGURE A23

PIPER DIAGRAM

MAJOR ION CHEMISTRY
TBTGS FUEL
TYPE - WATER
LOCATION 15B

▲ *1980*
■ *1981*



83-130

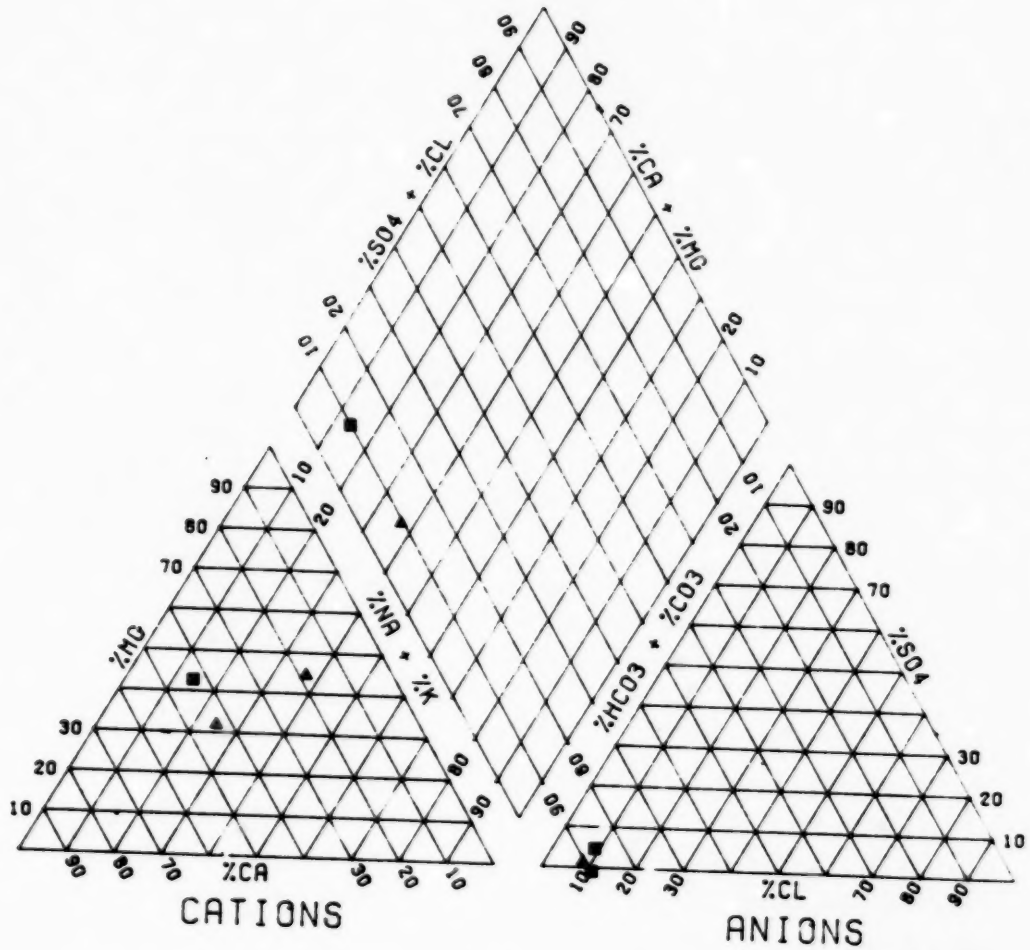
159785 RD

FIGURE A24

PIPER DIAGRAM

MAJOR ION CHEMISTRY
TBTGS FUEL
TYPE - WATER
LOCATION 16A

▲ *1980*
■ *1981*



83-130

159786 RD

FIGURE A25

PIPER DIAGRAM

MAJOR ION CHEMISTRY
TBTGS FUEL
TYPE - WATER
LOCATION 16B

▲ *1980*

■ *1981*

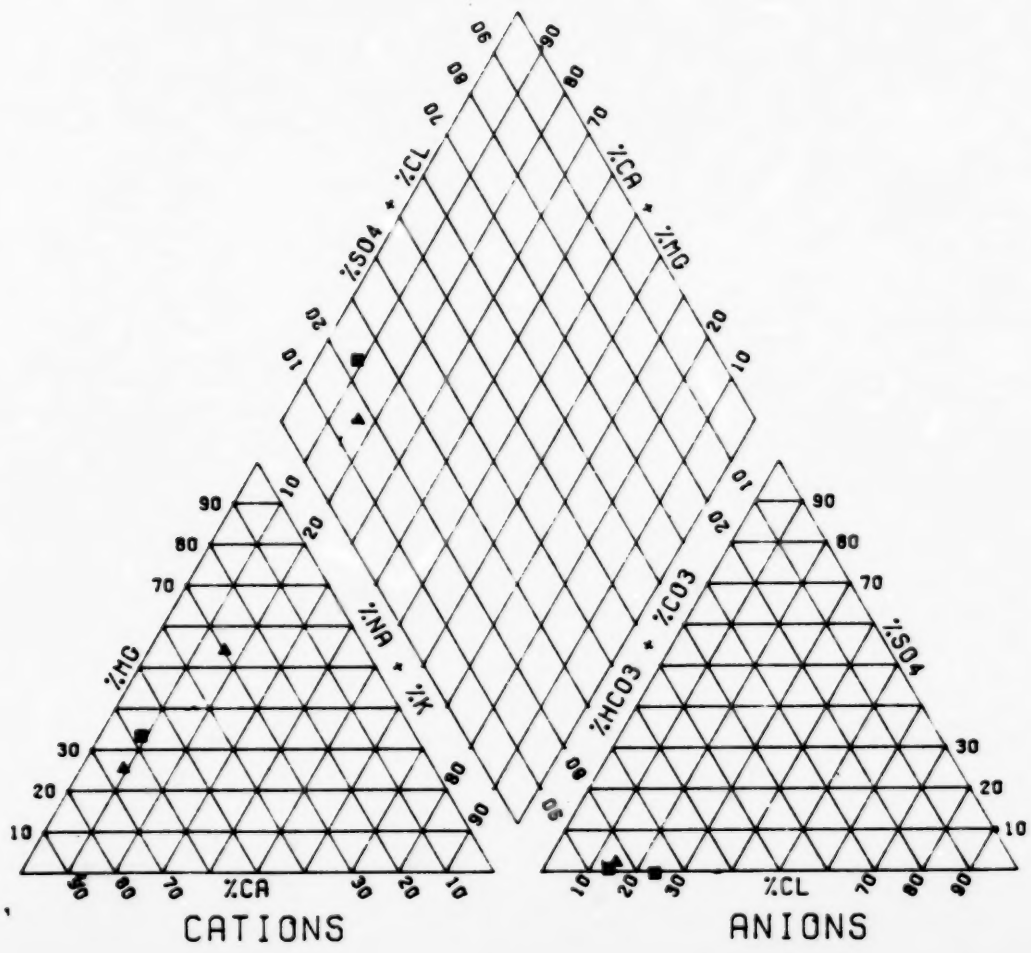


FIGURE A26

PIPER DIAGRAM

MAJOR ION CHEMISTRY
TBTGS FUEL
TYPE - WATER
LOCATION 17A

▲ 1980
■ 1981

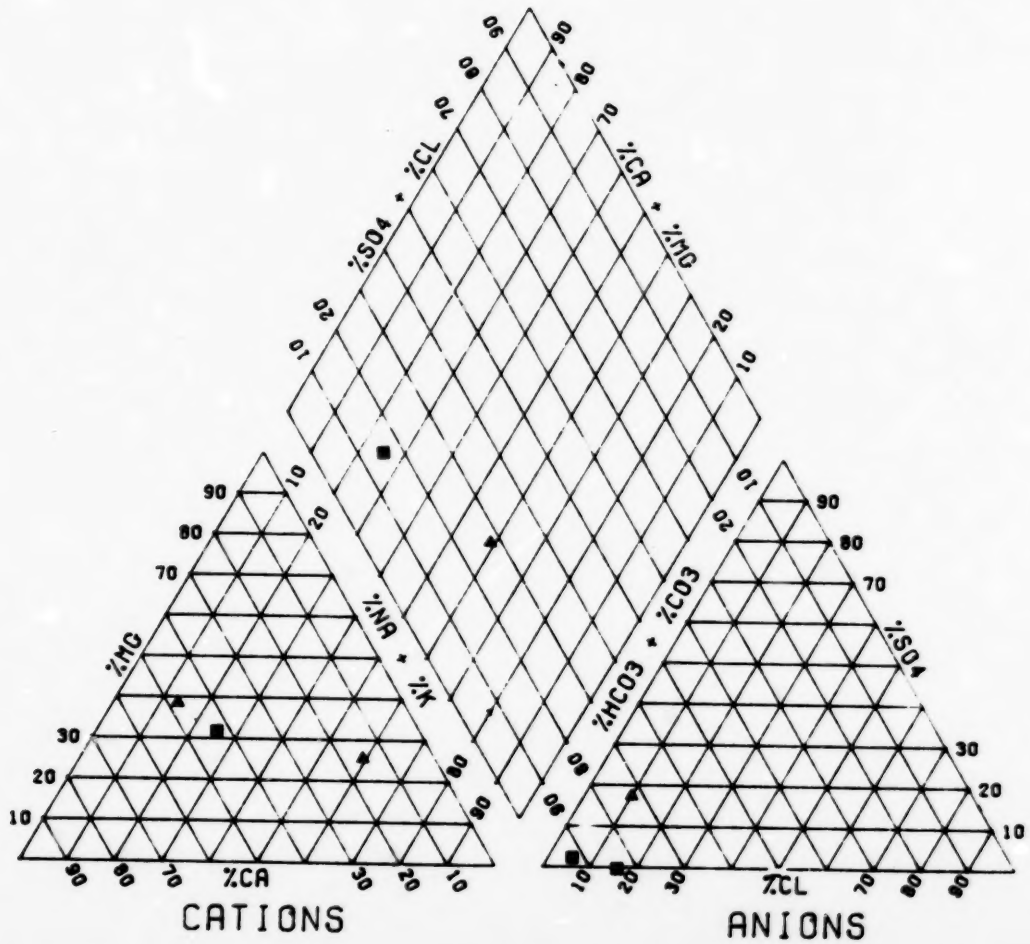


FIGURE A27

PIPER DIAGRAM

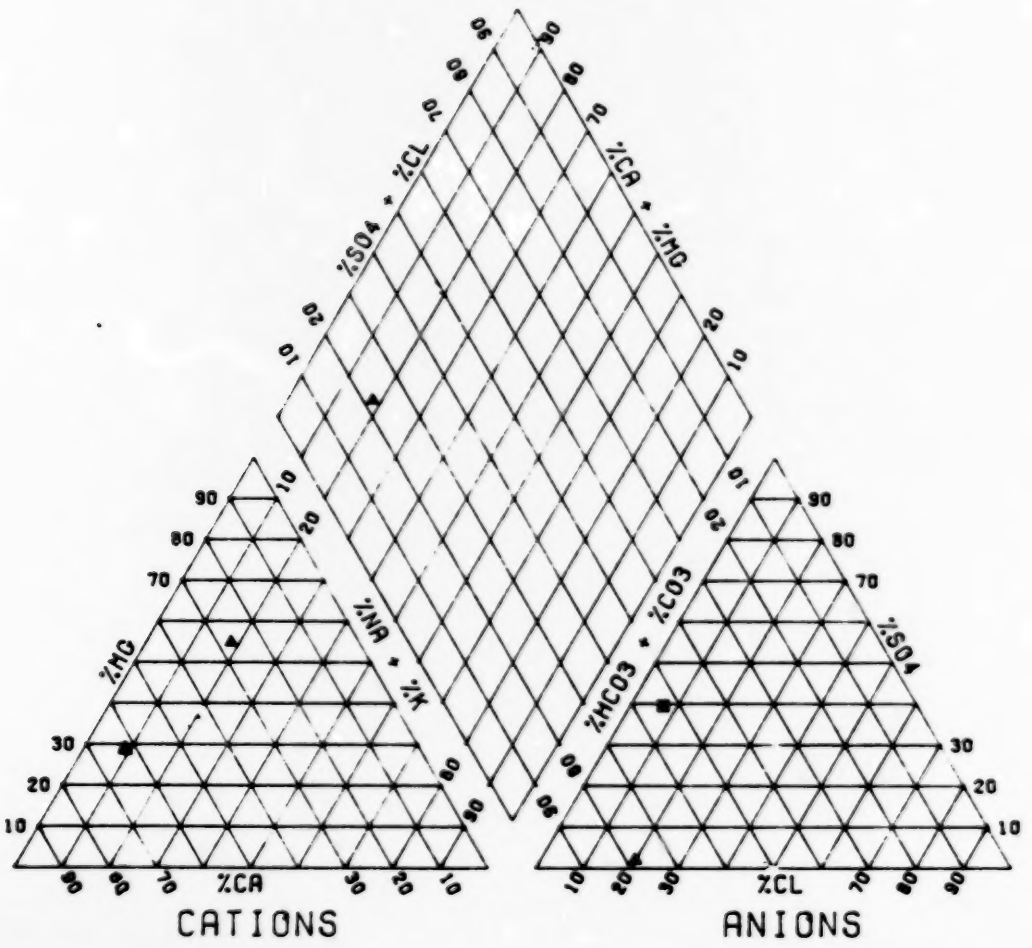
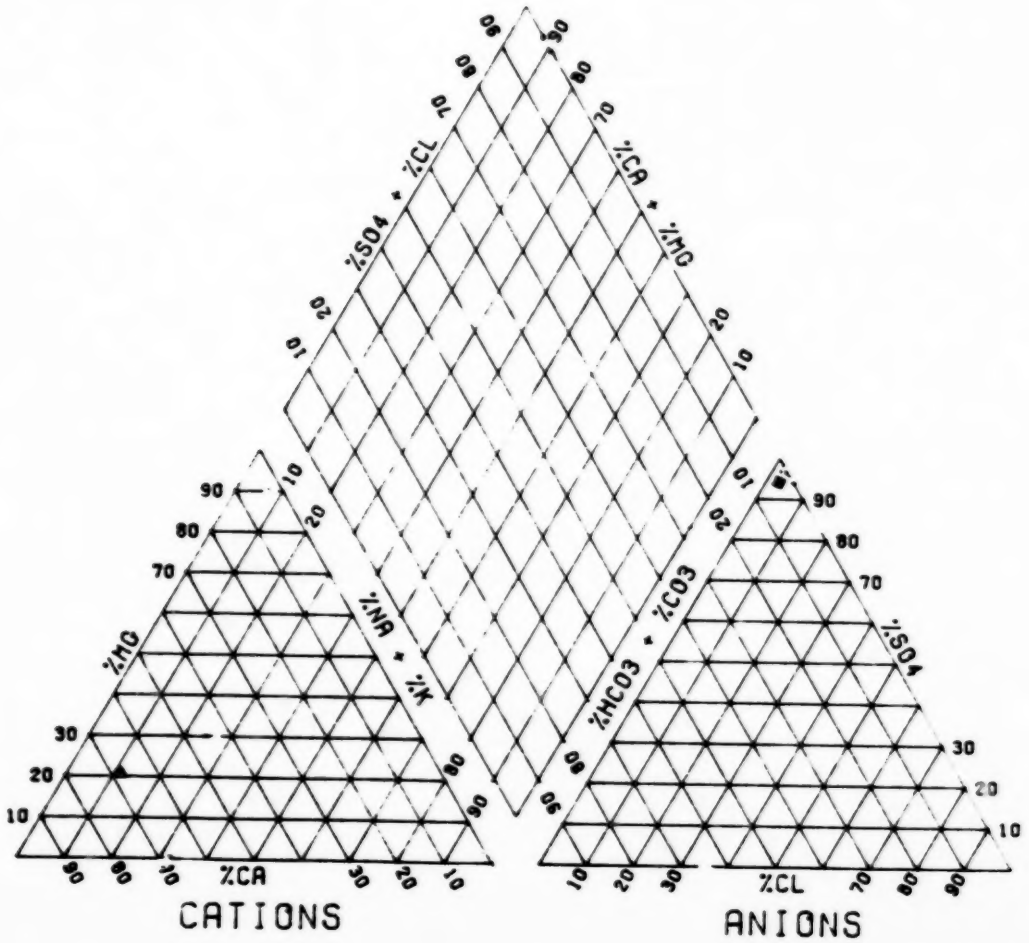


FIGURE A28

PIPER DIAGRAM

MAJOR ION CHEMISTRY
TBTGS FUEL
TYPE - WATER
LOCATION 18A

▲ *1980*
■ *1981*



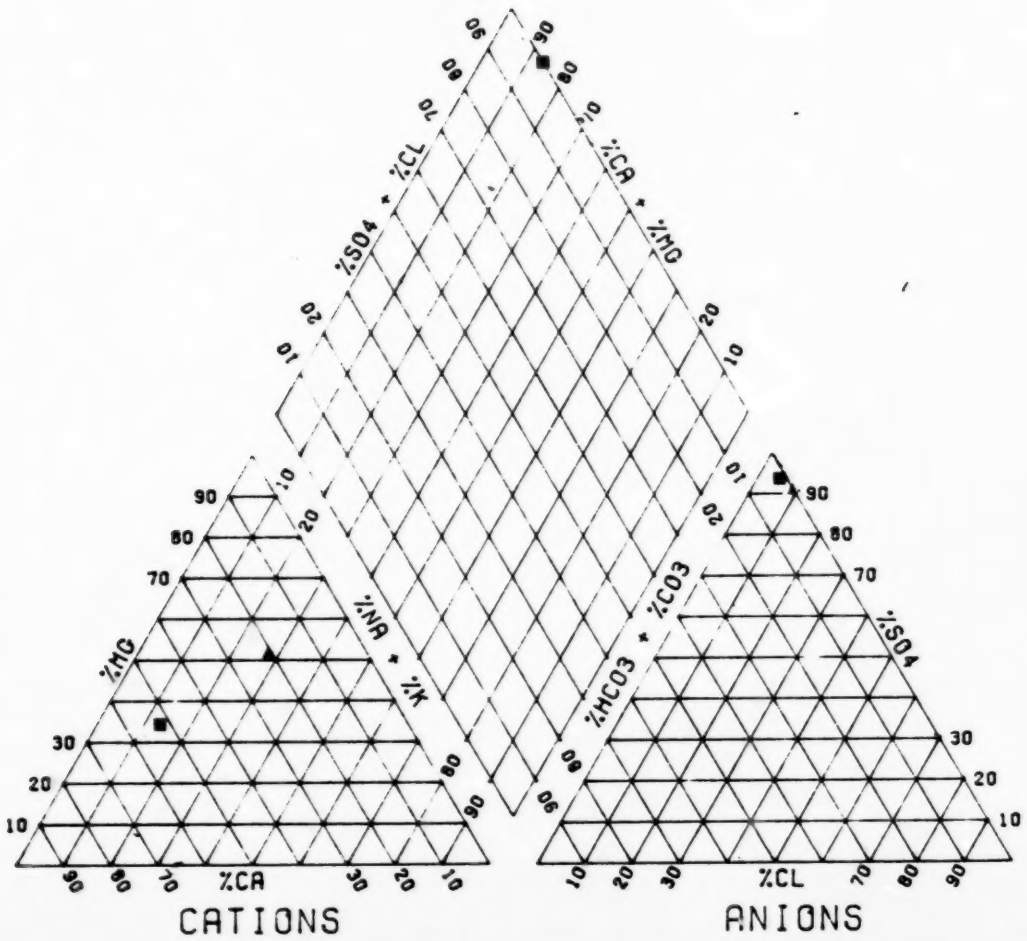
83-130

FIGURE A29

PIPER DIAGRAM

MAJOR ION CHEMISTRY
TBTGS FUEL
TYPE - WATER
LOCATION 18B

▲ 1980
■ 1981

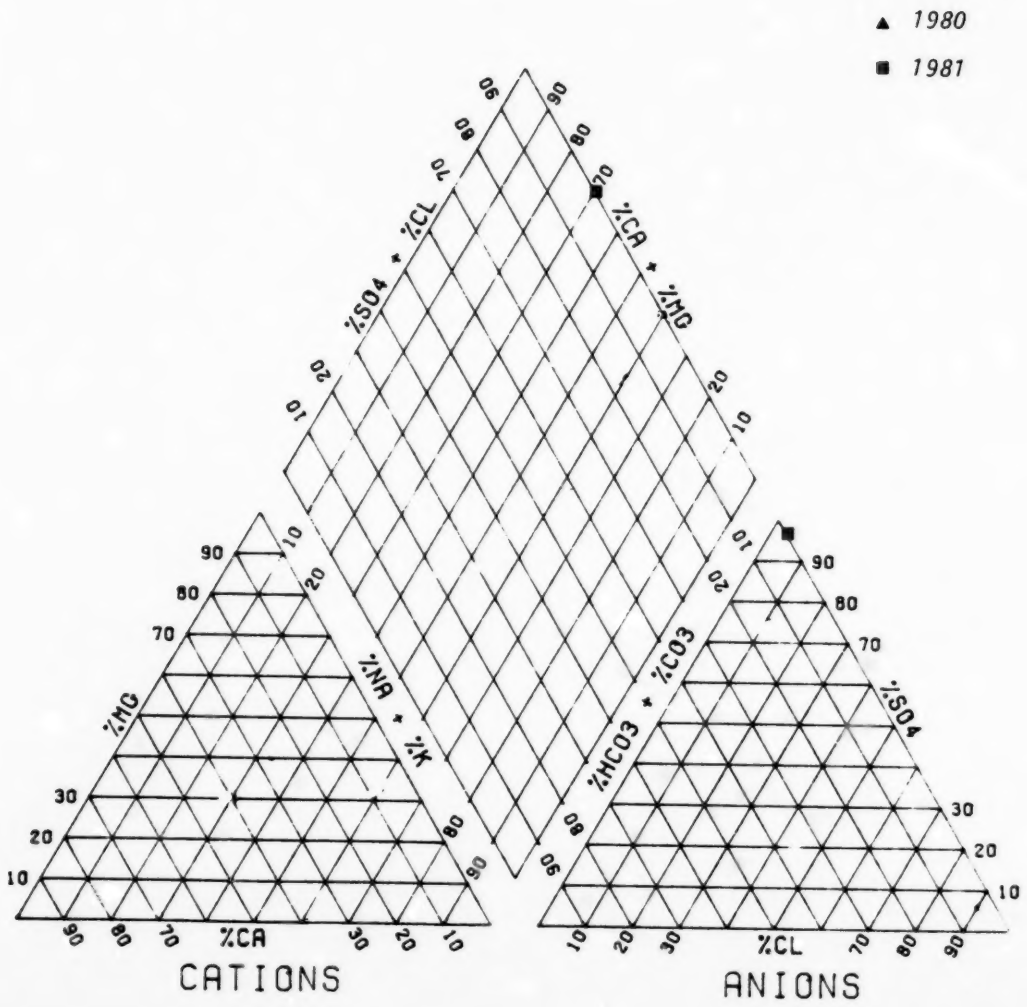


83-130

FIGURE A30

PIPER DIAGRAM

MAJOR ION CHEMISTRY
TBTGS FUEL
TYPE - WATER
LOCATION 19A



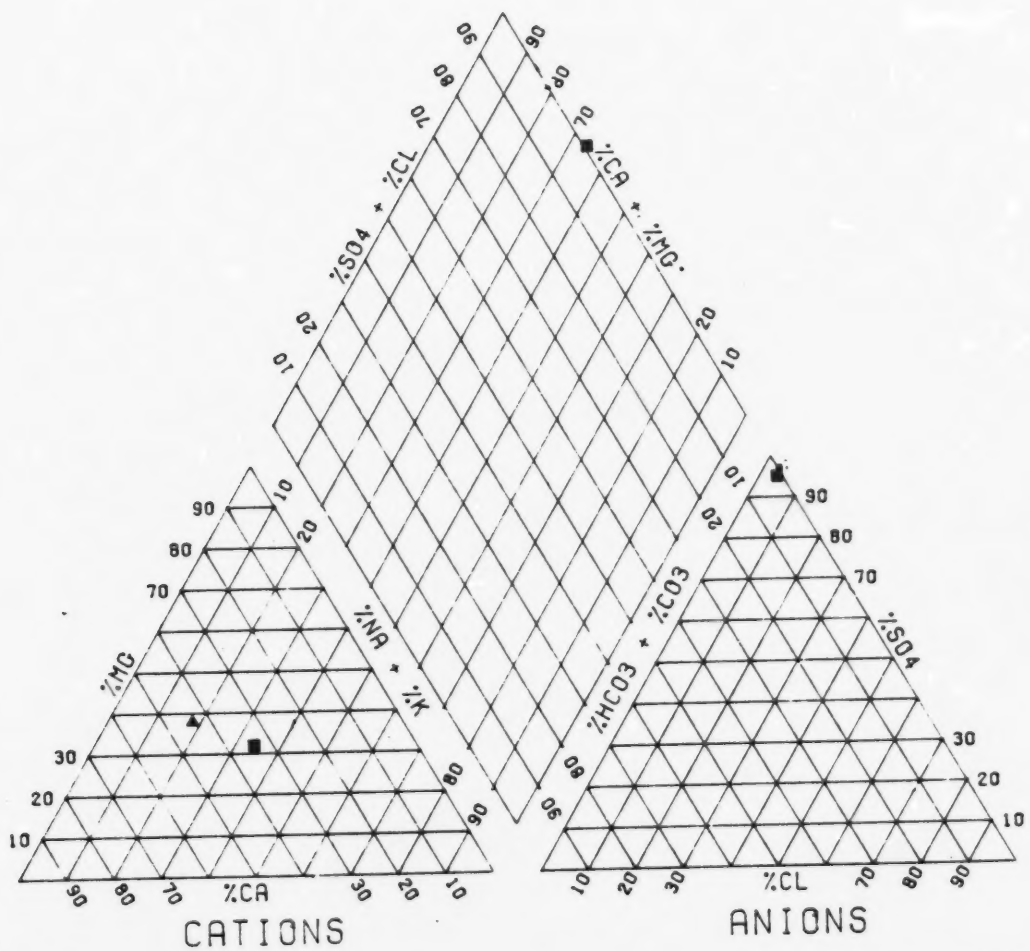
83-130

FIGURE A31

PIPER DIAGRAM

MAJOR ION CHEMISTRY
TBTGS FUEL
TYPE - WATER
LOCATION 19B

▲ *1980*
■ *1981*



83-130

FIGURE A32

PIPER DIAGRAM

MAJOR ION CHEMISTRY
TBTGS FUEL
TYPE - WATER
LOCATION 20A

▲ *1980*
■ *1981*

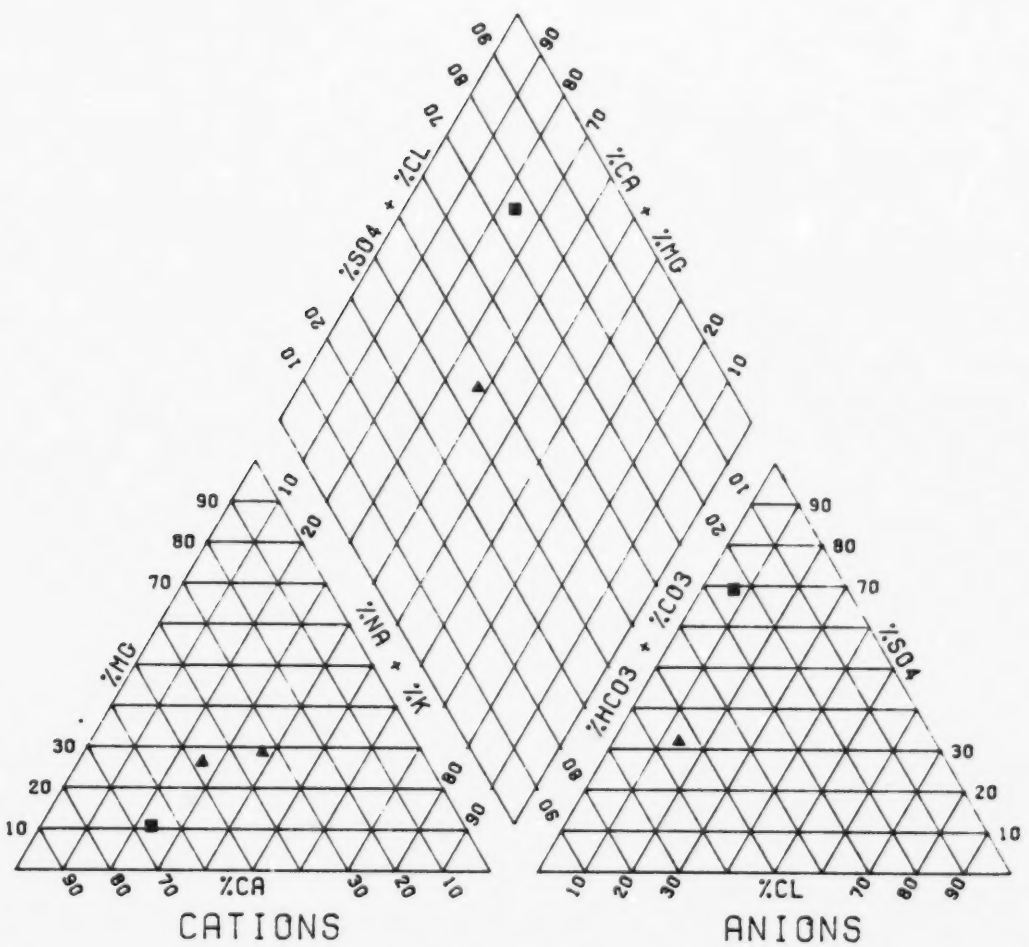
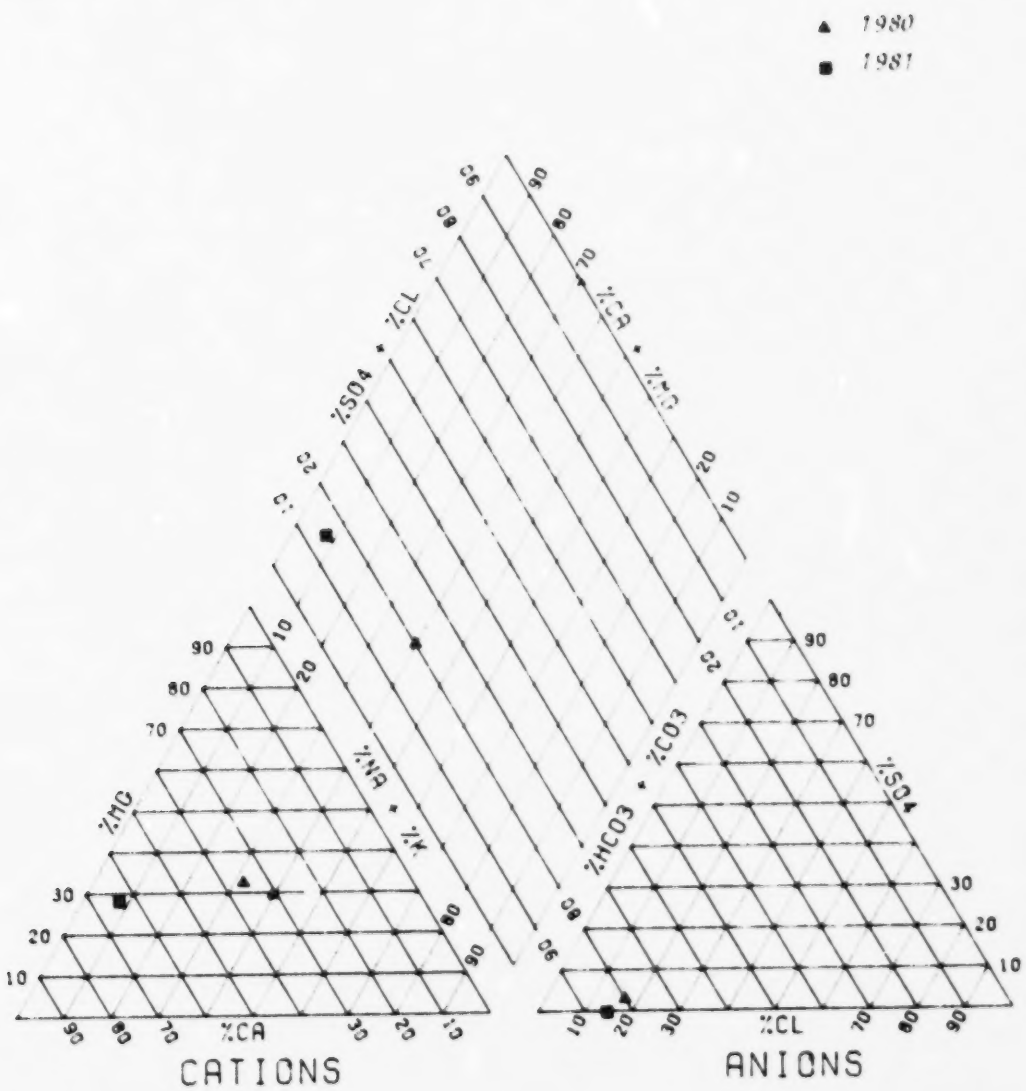


FIGURE A33

PIPER DIAGRAM



83-130

POOR

QUALITY

ORIGINAL